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Public Lighting and Street Safety

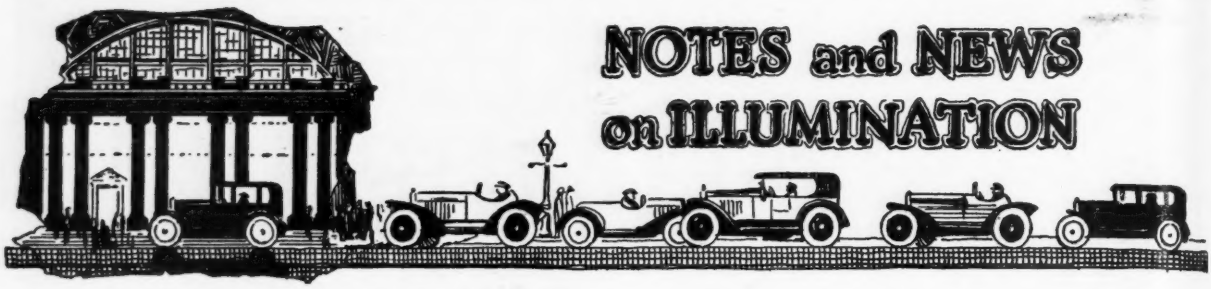
THE paper presented by Mr. Harold Davies at the National Safety Congress on May 5th, which is summarized in this issue (pp. 153-156), naturally devoted special attention to the claims of adequate public lighting in the interests of safety—which includes not merely the prevention of accidents but security of property and person. The original object of public lighting was undoubtedly to safeguard persons using the streets from robbery and violence. Of late increased attention has been drawn to this aspect owing to the apparent growth of organized crime in many cities. It has been remarked that assaults and robberies do tend to occur most frequently in streets and squares rather off the main thoroughfare and relatively poorly lighted. The same doubtless applies to burglaries—for which a curious seasonal variation, following inversely the duration of daylight throughout the year, has been recorded. The value of good lighting in assisting suppression of crime and disorder, universally recognized by the police, should not be overlooked.

This aspect, however, is still overshadowed by the other chief function of public lighting—which has indeed become its main one in these days of ever-increasing motor traffic—the safeguarding of persons from accidents in the streets. The figures now presented for 1931, 6,691 persons killed and 202,119 injured, are surely sufficiently grave. On an average nearly 600 people are hurt every day on our roads, and nearly 20 of them die. In one year of peace the casualties attain *four times* the total number of killed, injured or dead through disease during the whole of the Boer War. Put in another way, the figures are even more impressive. Since the termination of the Great War 1½ million people have been killed or injured in road accidents—a number equal to more than half the casualties of the British Forces in that great struggle. As Mr. P. Good has remarked in a recent letter to *The Times*, whenever these statistics are published they excite shocked comment, but in a few days the matter drops out of sight and nothing further is done. There is much to be said for Mr. Good's contention that the problem of this toll of the roads is an industrial as well as a social problem—certainly it is an essentially technical one—and that it should be made the subject of investigation by some body organized for scientific research. If such an enquiry were conducted on a scientific basis it is probable that suggestions of permanent value would follow, and the cost would surely be minute in comparison with the appalling loss in which the nation is annually involved.

It was remarked in Mr. Davies's paper that, as in Mr. R. Beveridge's paper before the National Safety Congress of 1930, that recent developments, in themselves admirable as aids to traffic, have tended to make the roads less safe for pedestrians. This view gains support from the striking figures recently presented by the Pedestrians' Association (indicating that whilst accidents to motor-cyclists and motorists show a material diminution those suffered by pedestrians have increased). To our mind it argues mental laziness as well as some degree of callousness to attempt to shift the blame to the unfortunate pedestrian. In other fields of effort engineers pride themselves on making things "foolproof," and if this is impossible in the case of street lighting, a great deal more might be done than is being done at present. The experience recorded in Edinburgh, where the application of ten methods (half of which are concerned with light) has reduced the number of accidents to *half* that recorded in 1926, is instructive.

The first step in any adequate scientific enquiry into this problem would be a much more detailed and scientific analysis of accidents than is undertaken at present. In 1919 the London Safety-First Council, at the instigation of the late Mr. Leon Gaster, passed a resolution affirming the desirability of including lighting conditions amongst official data on street accidents. Present published records afford no information on this factor, and rarely enable even an accurate division between night and day accidents to be made. Nevertheless such evidence as is available from special enquiries leads to the belief that the number of accidents occurring at night is disproportionately high and that the ratio of night accidents to day accidents has tended to increase progressively during recent years. Both these considerations emphasize the importance of adequate street lighting, and of such luminous devices or aids to vision as traffic signals, illuminated direction signs, white traffic lines on roads or demarcations of pavements, etc.—all essentially linked with an appeal to the eye.

The Association of Public Lighting Engineers has done good service in thus emphasizing their value, first at the Public Works, Roads and Transport Congress last year, and now at the National Safety Congress (1932).



The Illuminating Engineering Society

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Illuminating Engineering Society will be held in the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), at 6-30 p.m., on Friday, June 17th. 1932, when it is hoped that all members will make a special effort to attend. The presentation of the Annual Report of the Council and the Accounts for the past year will be followed by the Presidential Address, to be delivered by Sir Francis Goodenough, C.B.E.

Lighting at the Ideal Home Exhibition

There was much of interest in the lighting of the Ideal Home Exhibition. If the pillar of light proved to be less arresting than one had been led to anticipate the general scheme was on novel lines, a feature being the use of indirect methods somewhat similar to those that have lately become popular on the Continent. Recessed rectangular luminous panels in the roof of the stall proved to be a popular method. There can be no question that the lighting of such exhibitions is now carried out in a manner infinitely more pleasing to the eye than was usual a few years ago. Nevertheless, one was conscious of the impression that finality has not been reached in the lighting of the gardens and such open spaces as the Tudor Village. It is true that both were in themselves charming scenes, and that the lighting, by conventional methods, was adequate and substantially free from glare. But the light was received from evident artificial sources, and could not be accepted as equivalent to daylight—the appropriate condition for these outdoor areas. It would seem that no designer has yet grappled with the problem, certainly by no means an easy one, of imitating natural lighting for such scenes. If the problem is difficult the reward is great. Lighting indistinguishable from summer sunshine would surely capture the public imagination! The use of the muslin canopy overhead suggests that this is feasible, and in the case of the gardens there are obvious methods of heightening the illusion, for example by imitating the pleasant speckled illumination of a lawn caused by sunlight filtering through the foliage of trees.

Light and Architecture

A series of addresses by Mr. H. E. d'Andrade, of the Brooklyn Edison Company, which have recently been issued in pamphlet form, contains some striking illustrations and some suggestive comments. Those who were present at the recent discussion of the Lighting of Churches and Cathedrals will read with interest his views on the lighting of a Gothic church, as illustrated by an etching of Westminster Abbey. "Eliminate the shafts of light, flood the ceiling of a Gothic church with indirect lighting—uniform illumination—destroy the dim shadows that suggest immensity, and you no longer have a Gothic cathedral. You may have the body of the cathedral, but not the soul." The author, by means of a table, contrasts the requirements of commercial lighting and architectural lighting. A more elaborate supplementary schedule attempts to summarize the lighting effects characteristic of various periods of architecture. The Pantheon in Rome, which was lighted solely by one unglazed opening 27 ft. in diameter in the crown of the dome, achieves with daylight an impressive effect, and one not unlike that produced with artificial lighting in some modern interiors, for example the great hall in the present building of the Port of London Building. The dome of the famous church of Santa Sophia, which receives light from forty windows round the spring of the curve, has also been likened to the familiar modern system of artificial lighting involving the arrangement of a series of lamps round the base of a dome or other recess in the ceiling. Of interest also is Mr. d'Andrade's analysis of floodlighting, which is modified according to the object served, i.e., to reveal "mass," "form" or "detail."

Railway Carriage Lighting

Someone has been recalling the time when candles were regularly sold at bookstalls of railway termini, and were installed on window ledges by first-class passengers. The writer remembers candlesticks prepared for the purpose, furnished with a rubber sucker enabling them to be attached to the window-pane. If such devices are unusual now, it does not follow that the standard of illumination in all railway carriages is ideal. On many local lines the conditions are poor indeed, especially when compared with what is probably the "peak illumination," i.e., that furnished in some of the latest tube carriages (stated to be about 20 foot-candles). A relatively high illumination such as this, it is curious to note, seems to be of material value in overcoming that great drawback to reading in trains, the presence of vibration.

Sir Thomas Legge

The recent death of Sir Thomas Legge, who for nearly 30 years served as Senior Medical Inspector of Factories, removes one who did much to advance the study of industrial hygiene. He was a specialist on a number of problems such as those associated with anthrax and lead poisoning, and his contributions to international congresses helped to enhance the reputation of this country abroad. Following his resignation from the Home Office in 1926 he became medical adviser to the Trades Union Congress. Sir Thomas Legge took a considerable amount of interest in the work of the Illuminating Engineering Society. The writer recalls his presence as a guest at the annual dinner in 1910, when his response contained a plea for the establishment of a "standard of light" in basement rooms. He was originally brought in contact with the Society through his interest in the effects of ultra-violet light, which was afterwards extended to lighting generally. One is almost inclined to think that his enquiries on this subject marked the very beginning of the progressively increasing amount of attention paid by the Home Office Factory Department to illumination in later years.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Progress in Decorative Electrical Illumination

By E. H. PENWARDEN

(Paper read at the Meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C.2, at 6-30 p.m., on Tuesday, April 26th, 1932.)

IT is an interesting fact that about seventeen years ago, or, to be precise, on February 16th, 1915, Mr. F. W. Thorpe read a paper at a meeting of this Society, entitled "Some Notes on the Development and Design of Lighting Fixtures in Relation to Architecture, Interior Decoration and Illumination."

We are considering the same subject to-night, although the title has been somewhat abbreviated, and as I propose to commence where Mr. Thorpe left off it will be enlightening to quote his concluding remarks:—

"Finally, a word or two may be said on certain developments in lighting, which, while not strictly coming within the scope of fixture design, have a certain bearing on what has been said above.

The use of indirect and semi-indirect lighting should have a distinct influence on ceiling decoration, and it is conceivable that such methods might give rise to an entirely new system of decoration.

In buildings used mainly by artificial light (theatres, for example) the design of the ceiling has often been expressly adapted to artificial light. Domes have been constructed acting as reflectors, in other cases ceilings and columns of diffusing glass or alabaster have been 'built-in' and lamps mounted behind them, and cornice lighting has been applied in conjunction with decorative friezes; *but these novel methods are not applicable to general practice.*"

With the exception of the last sentence there is something distinctly prophetic about these remarks, and at the same time they reveal the fact that our modern ideas were actually being applied by the pioneers of decorative electric illumination seventeen years ago. That which was then a luxury has now become a common amenity.

Events move so rapidly in these days that seventeen years can be looked upon as a considerable period of time. During this period the greatest progress has undoubtedly been made in the development of electrical apparatus. It may conceivably be a matter of opinion as to whether certain developments that have taken place in recent years in the field of decorative electrical illumination can be considered "progressive" from an artistic point of view, but there can be no dispute regarding the progress in design and efficiency.

These developments provide unlimited scope for their utilization in the field of decorative illumination, and a study of events in this direction during the past few years should be "illuminating" in every sense of the word. The word "decorative" indicates the possession of artistic qualities, but as the essence of good design is that the article shall function in the manner intended, it is also essential to give adequate consideration to the scientific principles involved in the successful application of artificial illumination.

It is difficult at times to reconcile the interests of science and art, but with a little give-and-take on both sides successful results are assured, providing the respective exponents co-operate at the outset, and not after either one or the other has completed his scheme. At a later stage in this paper something further will be said regarding what is involved in co-operation between the architect and the illuminating engineer, and how, precisely, each may learn from the other. For the moment, all that need be said is that such co-operation, which has always been desirable, has now become *essential*. In the very latest systems of illumination the lighting equipment becomes so much an actual part of the architectural scheme that it can be no longer grafted on to it as an afterthought—a site must be provided for this lighting equipment at an early stage in the design, and its exact nature must then be determined.

To describe verbally even a few of the changes in fixture design that have taken place within the period we are surveying—nearly twenty years—would be an impossible task. I am proposing, therefore, to enlist the eye as well as the ear, and my lecture will be supplemented by a series of lantern slides, specially selected to illustrate the gradual and progressive modification in ideas on lighting fixtures.

(Much of this descriptive matter is necessarily omitted from the advance copies of this paper.)

During the early period of development about thirty years ago, when carbon-filament lamps ranging from 5 to 32 candle-power were in use, the flamboyant treatment of the metal fixtures appears to have been the accepted method of obtaining decorative effect. It was almost essential to use direct lighting, owing to the low efficiency of the lamps, but an attempt was made to screen them by means of more or less decorative shades.

The continued application of period design for interior decoration is responsible for the maintenance of the demand for electroliers and candelabra designed on traditional lines, but the tendency to

hold rigidly to conventional forms, more or less reproductions of the actual lighting units originally used is being challenged by many designers. It is contended by some that such reproductions are necessary to retain the atmosphere of the period,

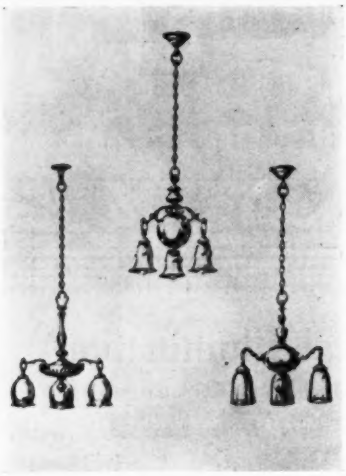


FIG. 1.—Three-light Direct-lighting Electrolier of popular conventional design.

but if this applies to such an indispensable adjunct as artificial illumination, should it not also apply to the occupant of the room? Now, immediately a person enters the room in modern dress, is not this so-called "atmosphere" destroyed? But if such

FIG. 2.—Electrolier of distinctive Period design (Georgian).

dress is permissible, then can we not make use of the available modern lighting facilities, providing always the housing and applied decoration are consistently in harmony with their surroundings?

The insistence upon the use of candle-type fitments in lighting units coupled with the complaints regarding their inefficiency was responsible for the introduction of a candle-type fitment of sufficient diameter to house an ordinary B.C. lampholder and to conceal the neck of a 40- or 60-watt Pearl lamp.

This innovation undoubtedly supplies the requisite lighting efficiency, and also, broadly speaking, gives the effect produced by candle fitments, but it must be acknowledged that it loses all sense of the shape and proportion of a candle.

This is one indication of the conflict between artistic effect and lighting efficiency, but the introduction of a fabric shade to screen the lamps will rectify this defect considerably and reduce the problem to a question of proportion.

The vertical line effect of candle fitments has a distinct appeal, and is possibly partly responsible for the introduction of frosted striplite lamps as a visible light-source.

FIG 3.—Modern Unit with Candle-type Fitments adapted for use with standard 40- or 60-watt Pearl lamps.

This is definitely a modern innovation, and lends itself to the severe vertical and rectangular treatment so much in evidence in modern decorative design. Elaborate multiple-tier units using large numbers of striplite lamps have been installed on the Continent, but experts there are discontinuing the application of such units on a large scale, owing to the difficulty and cost of maintenance. This objection does not, however, arise with smaller and more accessible units.

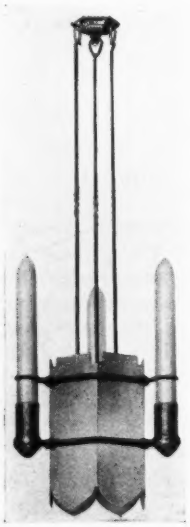


FIG. 4.—Example of application of Tubular Lamp, with single-ended B.C. attachment.

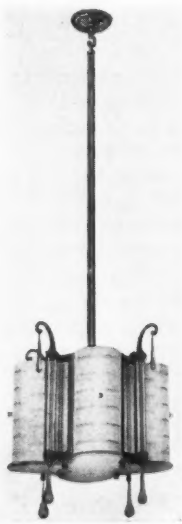


FIG. 5.—Pendant of modern design, with natural-colour tinted glass relieved with sandblasted engraved lines.

The striplite lamp, only partially functioned as a line of light in its application to modern lighting practice. The necessity for providing a wireway at each end caused serious limitations to its effective use under certain conditions, whereas

an efficient tubular lamp of similar character but with a single-ended B.C. attachment would fill the gap. Such a lamp was quickly produced, and is now available for use not only behind a diffusing glass but also as a visible light-source.

The most pronounced development in lighting practice in recent years, as applied to individual lighting units, is the introduction and extensive use of glass as a combined light-diffusing medium and decorative *motif*. In conjunction with this innovation the simplification, and in some cases almost complete elimination, of visible metalwork is a very marked feature of modern design, and is a complete reversal of the old ideas.

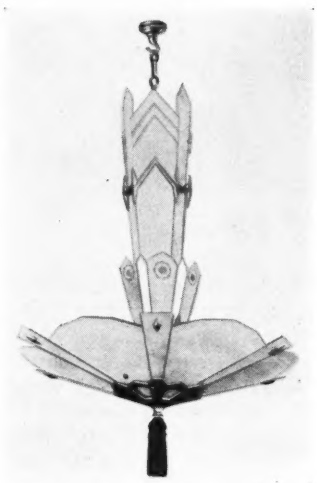


FIG. 6.—Modern type Free-edge Panel Glass Unit, relieved with engraved and etched decoration.

Heavy-moulded and pressed-glass panels were extensively used, and are still much in demand. Very attractive effects can be obtained by a combination of pressed-glass and sheet-glass panels, and pleasing

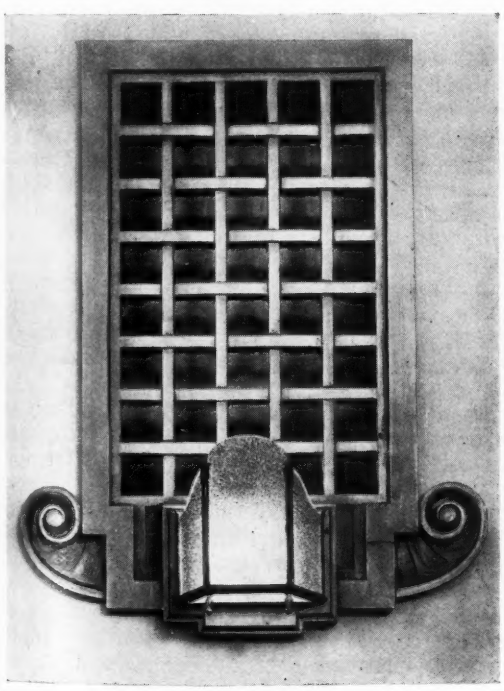


FIG. 7.—Lighting Unit forming integral part of decorative *motif*.

colour effects are introduced by tinting the panels to harmonize with the decorative treatment of the rooms. There is, however, a distinct movement in favour of the use of sheet-glass panel fittings, which are lighter in weight and lend themselves to more delicate treatment. Various types of figured glass are used, and pleasing decorative effects are obtained by sandblasting the surface of plain glass and introducing etched and tinted relief.

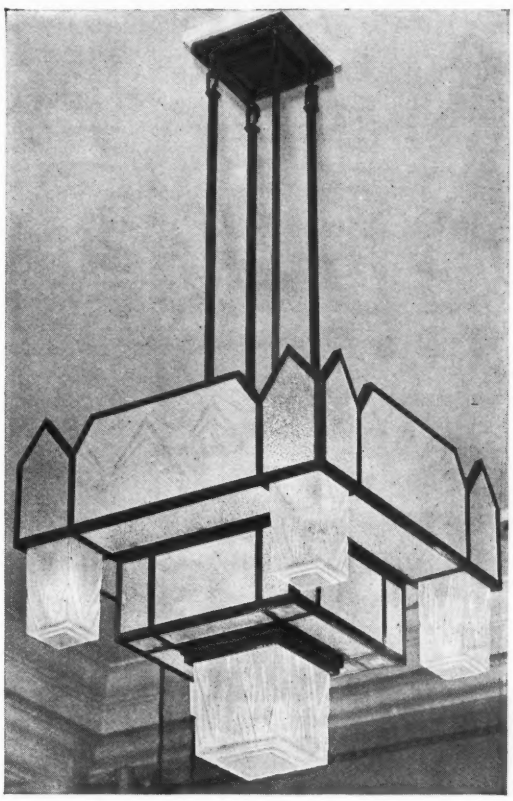


FIG. 8.—Modern three-tier Box-type Unit, glazed with "Crevasse" and Diamond Raindrop glass panels and moulded cubes.

There are a few types of panel-glass units of ultra-modern design emanating from the Continent which border on the grotesque and which have a very limited appeal to the discriminating public in this country, but it is only fair to acknowledge that the

FIG. 9.—Modern Decorative Lighting Units applied to existing interior decoration of pronounced Period design.

developments in decorative illumination that have taken place during the last five or six years are largely due to the originality and initiative of Continental designers and glass manufacturers, chiefly in France and Germany; but, having made this acknowledgment, let us confine ourselves to the progress and developments that have taken place in Great Britain.

Although we are still dependent on Continental glass manufacturers for certain kinds of decorative

glass, British manufacturers are now making many patterns of standard rolled glass in varying tints and with excellent diffusing properties, which are being successfully applied to modern lighting units. That known as Dewdrop or Raindrop is one of the most popular.

Internally frosted glass tubes are also employed as a decorative light-diffusing medium, and a variety of unique and pleasing effects can be obtained by combining ingenuity with imagination.

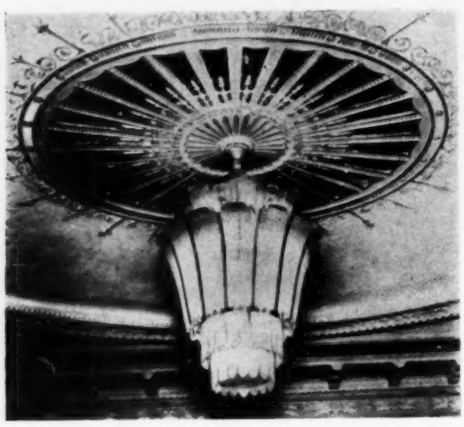


FIG. 10.—Large Modern Panel Glass Unit, 7 ft. 6 ins. diameter, with sandblasted and engraved decoration applied to decorative ceiling of distinct Adam character.

The introduction of small individual lighting units forming an integral part of a decorative *motif* is a welcome indication of the acceptance of the principle that artificial illumination should be given consideration at an early stage in the planning of a decorative scheme. Very beautiful and satisfactory results have been obtained by using a little forethought in this direction, especially where large areas are involved and evenly distributed illumination of adequate intensity is required.

It is extremely hazardous to embark on an important decorative lighting scheme without some foreknowledge of the resultant illumination, and the only means of ensuring success is for the fittings designer, the architect and the illuminating engineer

FIG. 11.—Modern Lighting Units applied to classical interior decoration.

to act in concert. Even so, the exact predetermination of foot-candles may present great difficulty. It is true that an illuminating engineer working from first principles should theoretically be able to calculate the illumination derived from each element in the lighting scheme and thus predict the resultant effect. But in the case of extensive luminous surfaces the calculation is extremely intricate, and there is the further problem—how to evaluate with certainty the percentage of light transmitted or reflected from the various materials used. In these days, when coloured lamps and surfaces and decorative glasses of such varying translucency and diffusion are prevalent the mere variety of material available alone serves to make exact calculations difficult, if not impossible.

FIG. 12.—Large Ceiling Fitting as an example of the application of soundly constructed sheet-metal craftsmanship.

How, therefore, is the ultimate illumination in the case of a highly original and decorative lighting installation to be predicted? In some cases assistance may doubtless be obtained from the study of small models. But in the great majority of cases one would probably not be far wrong in suggesting that the illumination is determined (and usually determined with very fair approximation) by a species of "enlightened guess." A designer familiar with measurements of illumination, and accustomed to scheming out installations of varied kinds, arrives at an estimate—not extremely exact, not very wide of the mark—by a sort of mental summation of past experience.

There is such a variety of form and design in modern decorative illumination that it is only possible to touch the fringe of the subject, but a few selected examples of individual units, with a brief description, will help you to visualize some of the developments that are taking place in this direction.

The problem of the illumination of existing interiors of pronounced period or classical design has already been touched upon, but I should like to make further reference to the feeling prevalent with many architects and designers that modern lighting practice is incongruous in such surroundings. Personally, I do not share that feeling, but, on the contrary, claim that a carefully designed modern unit not only increases the efficiency of the lighting but also enhances the decorative effect without destroying the harmony.

The advantages of soundly constructed sheet-metal framed panel glass units are recognized by many architects. This form of construction, if carried out by experienced sheet-metal craftsmen, is remarkably strong and light in weight, and is particularly suitable for application to units of large dimensions, such as are frequently used for cinema lighting.

Equally large free-edge panel glass units are also popular, but with fittings of this size and character it is important to give due consideration to the question of maintenance and to make suitable provision for obtaining access to the interior of the fitting for cleaning and renewal of lamps.

The introduction of laylights in the ceiling is a system of lighting extensively used, but it is essential to have adequate space above the ceiling line for the installation of lamps at the requisite distance from the glass.

FIG. 13.—Modern Lighting Unit in the Saloon of the s.s. "Monarch of Bermuda."

FIG. 14.—Example of Artificial Illumination by means of laylights over Swimming Bath in s.s. "Empress of Britain."

It is generally considered desirable to avoid prominently visible lamp positions, but in cases where the structural and lighting limitations make this unavoidable the effect is more pleasing if the positions of the lamps have a definite relation to the decorative treatment of the design.

In connection with laylights, and likewise in connection with luminous lintels, pillars, and the like, a "spotty" effect is usually unsightly, but it is by no means easy to frame rules which would invariably ensure approximately uniform brightness of the surface. Much can be done by surrounding the lamps by a matt white diffusing surface, and the problem is rendered easier when the distance between the lamps and the glass is capable of adjustment. But the nature of the glass itself is a dominant factor, and decorative types of glass reveal surprising differences in behaviour when actually put to the test.

Many of the standard rolled figured glasses when used in laylights below a lantern light are excellent surface diffusers under daylight conditions, but with artificial lighting, where the light-source is provided by a number of lamps of comparatively intense spot brilliancy, the effect is entirely different and it is often found necessary to sandblast such glass to obscure the interior structure.

Rectangular ceiling fittings are frequently employed as a substitute for laylights where the structure does not permit of installing the lamps above the ceiling line. This type of fitting is particularly suitable for rooms of large area and low ceiling height. In such rooms any unit in the nature of a pendant tends to emphasize the lowness of the ceiling, but it is also important to design the units to harmonize with the predominating characteristics of the decorative treatment of the room.

Illuminated beam lighting is also frequently adopted, but it is sometimes necessary to resort to auxiliary lighting units to assure even illumination throughout the room.

The application of glazed fittings on pilasters checking under the beam gives wide scope for decorative treatment of an architectural character, and at the same time provides a useful source of illumination. Such units combined with partial beam lighting can be readily visualized, and the possibilities of various combinations of this type of lighting will suggest themselves to the decorative artist.

We are now bordering on the realms of architectural illumination, which has made such progress in this country that it is scarcely necessary for me to define the term. It is the outcome of the recognition, on the part of the architect, of the possibility of obtaining decorative effects by means of light. Seventeen years ago Mr. Thorpe concluded his paper with a reference to "the much-needed co-operation between the architect, the engineer and the fixture designer, with a view to raising the artistic as well as the practical aspect of illumination to a higher plane."

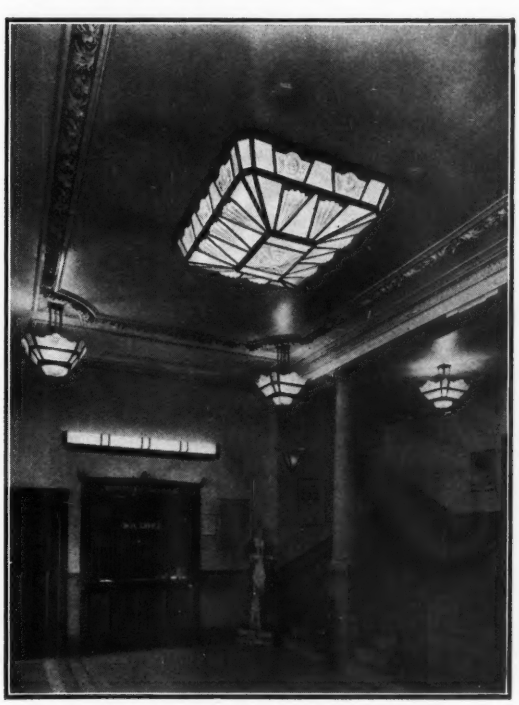


FIG. 15.—Flush-type Rectangular Ceiling Fitting as a substitute for laylight.

The need for such co-operation is being continually preached to-day. May it not be well for us to try to visualize precisely what is meant? We are

still feeling our way towards avenues for co-operation, but there are two main aspects that deserve recognition. There is, firstly, the practical co-operation that an architect can furnish by conferring with

FIG. 16.—Example of Luminous-glass Cornice Lighting.

the illuminating engineer and the fixture designer in the early stages of the design, and subsequently providing them with situations for fittings, spaces for ducts, wiring or accessories, and such knowledge of his own ideas as will enable a harmonious lighting scheme to be worked out. But complete co-operation, in the sense of interchange of knowledge, would probably only come later when the sharing of further experience in lighting schemes has enabled the lighting engineer to assimilate, to a greater degree, the ideas and impressions that mould the outlook of the architect—which in fact are often exceedingly difficult to explain in words, being the unconscious results of past experience and tradition, and can only be realized by sharing in the work to which they give rise.

Similarly, constant co-operation with the illuminating engineer may give, and in many cases has given, the architect new confidence in regard to the

FIG. 17.—Example of Beam-type Lighting.

numerical expression of light-values. At present he feels instinctively that in decorative lighting schemes involved mathematical calculations are fruitless. But in course of time he will acquire what is much more valuable from his standpoint—the rapid mental process referred to earlier in this paper, which enables experience of many installations of differing design but furnishing known illuminations

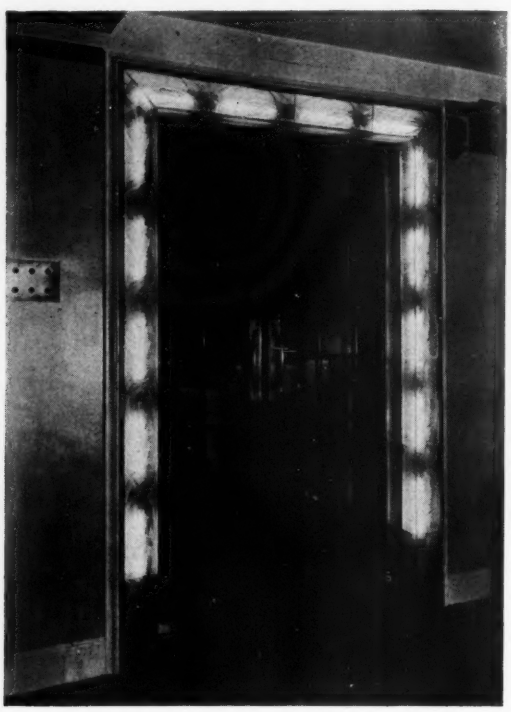


FIG. 18.—A Simple Example of Architectural Illumination which should be classified as luminous decoration.

in foot-candles to be crystallized, and an approximate judgment of the resultant illumination in any particular case to be made.

It is of the greatest importance to distinguish the difference between "luminous decoration" and "decorative illumination." "Luminous decoration" may be described as that which is possibly very satisfactory as an illuminated surface treatmeet requirements in the room. "Decorative illumination" is that which not only gives the desired decorative effect but also provides adequate illumination to meet requirements. This distinction is frequently overlooked by architects and designers of decorative lighting schemes. The results of illumination by means of built-in lighting fixtures are often erroneously estimated on the basis

FIG. 19.—Illuminated Surround forming capital to column, combined with pendants and ceiling fitting.

of the total wattage of lamps normally used in relation to the area to be lighted. There are, however, many factors to be considered, chief of which are: absorption of diffusing media, limit of effective

FIG. 20.—Example of Modern Cinema Lighting combining luminous cornice lighting, flush wall panels, and luminous capitals to column.

light distribution, efficiency of reflecting surface behind the lamps and position and spacing in relation to the area requiring illumination.

Glass is the principal diffusing medium used. Broadly speaking, its absorption increases proportionately with its surface light-diffusing properties. For instance, plain satin acided glass has a very low absorption and poor surface diffusion, whilst white opal glass may have a very high absorption, but has excellent diffusing properties.

Flashed opal is one of the most valuable types of glass available, as the thin layer of opal has a greatly reduced absorption factor without a correspondingly proportionate loss of diffusion.

The limit of effective light distribution requires careful consideration, especially with built-in lighting, and is closely related to the position and spacing of the lighting units over the area requiring illumination. It can generally be accepted as a principle that with this type of lighting the layout should be evenly and extensively distributed over the area to be lighted. For instance, if the light-source were concentrated in the middle of the room the falling-off in the intensity of illumination at the sides of the room would be very rapid, and far more pronounced than would be the case if a pendant unit with equivalent wattage, which distributed the light in all directions, were used.

FIG. 21.—Practical Architectural Lighting by means of a luminous moulding surround in each ceiling bay.

The provision of a reflecting surface behind the lamps plays an important part in the surface appearance of the unit, as well as in its lighting efficiency, but, generally speaking, with built-in lighting of the glass-panel or laylight type, a plain matt white surface at the sides as well as at the top is effective, and usually possible and inexpensive to provide.

Illuminated surrounds forming the capital to the column are frequently adopted as an architectural lighting feature, giving very satisfactory illumination results, but in cases where the number and spacing of the columns is insufficient to provide adequate illumination over the whole of the area to be lighted, ceiling fittings and pendants may often be introduced with pleasing effect.

Cornice lighting may fittingly be classified as "architectural illumination," and is now so well known that it is scarcely necessary to describe it in detail, but here again it is advisable to emphasize the fact that it is a highly specialized subject requiring expert scientific application to assure success.

Apart from cornice lighting, many successful indirect-lighting installations have been carried out by means of special silvered-glass reflectors concealed in demi-coupe brackets, but this method can only be adopted where the architectural treatment of the interior lends itself to the application of units suitably spaced to give even distribution of light over the area requiring illumination.

Another recent development in the application of indirect lighting is the use of floor standards incorporating specially designed extensive type silvered-

FIG. 22.—Indirect Lighting by means of reflectors concealed in Demi-Coupe brackets.

glass reflectors used in conjunction with projector type lamps. There may be some question as to whether this type of lighting should be classified as "decorative illumination," but it is undoubtedly a development in the application of modern lighting apparatus and methods which can be successfully applied where other forms of indirect lighting are unsuitable, and it therefore is worthy of attention. This also applies to the lighting of churches and cathedrals, where concealed lighting has been so successfully applied that it has not only provided more efficient illumination but has revealed architectural beauties that have, in the past, been very successfully concealed in the gloom.

In many instances, however, concealed lighting is not a practical proposition, and it is therefore essential to resort to direct-lighting methods. This applies more frequently to churches where the architectural treatment does not lend itself to the concealment of the necessary reflectors. In such cases direct lighting is essential, and various novel methods have been adopted in churches of modern design, such as concealing the lamps behind suspended screens and, therefore, projecting the light in one direction only.

The most favoured system, especially in churches of Gothic design, is to use suspended units in lantern form incorporating special reflectors

for concentrated downward illumination, with auxiliary lights illuminating the side and top panels of the lantern which are controlled on a separate wiring circuit to enable the intensity of illumination to be reduced evenly throughout the church if and when desired. Such units have an added advantage in that the effective fixing height is well above the line of vision, thereby leaving an uninterrupted view of the pulpit and chancel. The form and decorative treatment of the lanterns can be varied to suit requirements, but it is essential that the correct type of reflectors is selected to conform to the height-spacing ratio governing each installation.

Floodlighting is such an important development of modern illumination that brief reference must be made to it, but this type of lighting would be more fittingly termed "illuminated decoration." Municipal authorities at seaside resorts have been quick to recognize the fact that artificial illumination is an attraction. The floodlighting of public buildings during the period of the recent International Illumination Congress, and the Faraday Centenary celebrations, revealed in an unsuspected manner the architectural beauty and grandeur of many of our notable buildings.

Having reviewed the foregoing remarks, I am more than ever conscious of the fact that the available illustrations at my disposal are totally inadequate to convey to you the full extent of the progress that has been made in decorative illumination. It would be impossible in the limited time available adequately to cover so extensive a field. The pronounced omissions are the smaller units of great variety, box-shaped units of quaint and attractive unbalanced design, cylindrical-shaped units, some composed of an assembly of thin clear-glass rods, and many forms of striplite lamp fittings, glass-panel fittings, and so on, mostly suitable for domestic lighting, all of them typical of modern ideas.

Speaking generally of modern lighting practice, more especially from the fittings design point of view, the hard-headed business man is asking the question "How long will it last?" Some believe it has come to stay, others that it is a passing fancy, but one fact stands out clearly, and that is that the increased supply and reduced cost of current and lamps will create an increasing demand for decorative lighting.

It is problematical as to which particular type of design or method of lighting will be adopted for future development out of the present somewhat chaotic conditions, but there is one very important

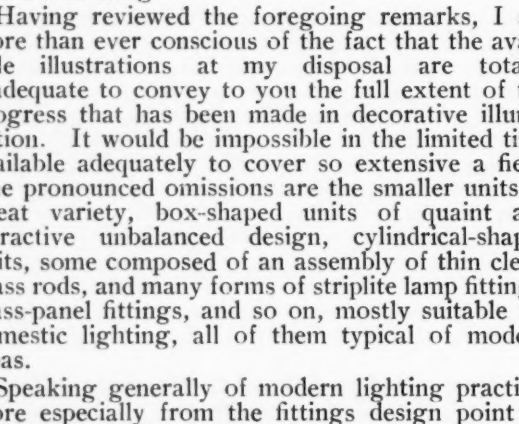


FIG. 23.—Indirect Lighting by means of floor standards.

consideration which, in my humble belief, will have a pronounced influence on this subject, and that is the question of maintenance. This applies equally to the design of individual units and built-in lighting. In large public buildings where there is a maintenance staff the problem is not so acute, but what of the smaller buildings and private houses? Take, for instance, the somewhat fragile construction necessary for the assembly of many panel-glass units and the corresponding difficulty and risk of

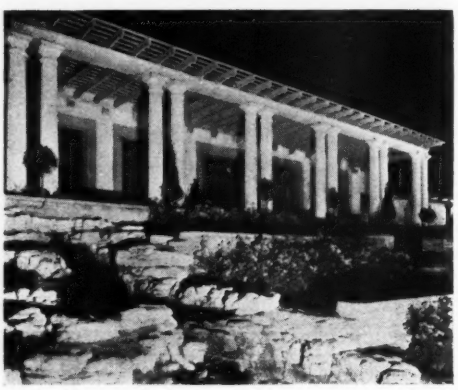


FIG. 24.—External Illuminated Decoration by means of floodlights.

breakage in dissembling the glass for cleaning. The modern housemaid will have to take a course of instruction on this subject if she is to claim efficiency.

Efficiency is a word which is often sadly abused in its application to decorative lighting, but on the other hand it is unwise utterly to ignore it. It appears many times in this paper, but after careful review it can be reasonably claimed that it has not been misapplied.

Finally, I must make grateful acknowledgment to the architects and designers responsible for many of the decorative schemes and designs of fittings thrown on the screen to-night. This is not a mere formal acknowledgment, for it also conveys appreciation of the evidence it affords of the progress that is being made in the direction of co-operation between the architect, the engineer and the fittings designer.

No man can be specialist in every subject, and real progress in decorative illumination lies in the co-ordination of science and art.

DISCUSSION

The CHAIRMAN (Lieut.-Commander Haydn T. Harrison) congratulated Mr. Penwarden on his excellent paper. As the author had said, much was to be gained by co-operation, and he thought that the paper itself furnished a good example of this.

Mr. T. P. BENNETT, in opening the discussion, also congratulated Mr. Penwarden on his comprehensive paper, in which a great variety of fittings was illustrated. The architect was usually confronted at the outset by a practical problem, namely, whether direct, indirect or semi-indirect lighting should be adopted. As Mr. Penwarden had remarked, the running cost of an installation was often a factor of importance, and this in a great measure determined the choice.

Proceeding, Mr. Bennett referred to various special difficulties that he had met in connection with lighting installations. In commenting on the use of dimmers for producing gradual variations in illumination, he remarked on the difficulty of obtaining a type which would effect a gradual diminution in the brightness of the lighting without sudden jumps, and yet was not unduly expensive. He would be grateful if Mr. Penwarden could tell him of an

effective dimmer which complied with these conditions. In connection with colour schemes the contrast in brightness between different objects in an interior was often of considerable importance. The fact that most surfaces gave rise to a certain amount of polished reflection often made it difficult to obtain complete diffusion and to get exactly the effect one desired. He had, however, recently found a variety of petrol paint which gave a surface that was almost if not absolutely matt. Mr. Bennett also referred to various special cases where exceptional high illumination was needed, such as the lighting of bars and show-cases, and asked for information on desirable figures. In conclusion, he emphasized the vital importance of practical design as well as the ornamental appearance of fittings. Most of the modern types were extremely intricate and almost impossible to keep clean. Naturally the available illumination quickly diminished when fittings became dirty, and it was important to give much consideration to the question of ease in cleaning. Fittings should be substantially dustproof, and should present as few crevices as possible liable to become encrusted with dirt. He felt that, generally speaking, too little attention had been paid to standardization in design. It seemed to be difficult to obtain fittings which were at once well designed and reasonable in cost, though apparently quite inexpensive fittings of good design, into which an enormous amount of work had been put, were obtainable on the Continent. Such fittings should be equally available in this country. Mr. Bennett concluded by again expressing appreciation of the manner in which the design of lighting fittings had been reviewed by the author.

Mr. F. G. THOMSON gave a demonstration of a new lamp that had been recently produced by his company. It marked a new departure in electric-lamp design, and in some respects was unique. The lamp was of tubular form, being 500 mm. (20 ins.) long and 30 mm. ($1\frac{3}{16}$ ins.) in diameter, and contained a filament stretching from end to end. The contacts of the lamp were not situated at the ends, as is the case with the normal striplite lamp, but at the sides. Therefore, this lamp lent itself admirably to cornice, show-case, shop-windows and decorative lighting. The contacts that were of a special nature were small, and were placed slightly away from the ends of the lamp.

These lamps provided for a continuous line of light since it was possible to place them end to end. With suitable fittings such as could be readily concealed, decorative luminous designs in many colours could be produced, for example on a ceiling or wall. A demonstration showed that the sprayed lamp furnished a well-diffused tube of light.

Mr. Thomson also mentioned, as an instance of the utility of the lamp for special purposes, its application for the lighting of a glass panel forming a door frame, which had been illustrated earlier in the evening. He remarked that the effect might be improved by using this new lamp. He assumed that opal tubular lamps of about one foot long were used in this panel. The dark patches evident in the picture shown could be eliminated by the use of the new tubular lamp which he had demonstrated.

It was explained that at present the lamp was only available in the 40-watt size and for use of 100-130 and 200-260-volt circuits. In response to enquiries, Mr. Thomson mentioned that the lamps at present cost a guinea (with a 10 per cent. addition for sprayed lamps), and the holders, two of which were needed for each lamp, half a crown each. (Members were afforded an opportunity of examining these lamps more closely after the meeting.)

Mr. W. R. RAWLINGS, in thanking the author for his paper, remarked that he had given a very fine survey of lighting fittings up to the present time. Possibly he (Mr. Rawlings), like Mr. Thorpe, had been born too long ago—but he must confess that he was not converted to the new type of fittings. Some modern designs he admired, and others he did not. In the latter class he included the peculiar fittings composed of glass plates, often with shades attached which could not be readily cleaned without risk of breakage. Many of these fittings absorbed a considerable amount of light. It was true that the price of electricity was now less, but nevertheless excessive use of current resulting from waste of light which produced heat was undesirable. Some of the designs as applied to "architectural lighting" seemed to him unnatural. For instance, it was odd for the lighting to come from the architrave, as occurred in the doorway of a well-known hotel in the Strand. He had also observed luminous bannisters and handrails and similar objects which did not seem to be a natural source of light. On the other hand, he thought that laylights and artificial windows, from which one expected light to come, produced quite a pleasing effect.

Mr. Rawlings put in a plea for the traditional lighting evolved in the past, during periods when some of the finest artists of Italy and France had produced designs which were still a pleasure to look at to-day. He questioned, for example, whether the fittings of the Louis XVI period had ever been surpassed in any period of the art of decorative lighting. Personally he had an affection for the candle. Special types equipped with quite small B.C. holders for electric candles were now available. Candles afforded a comfortable means of illumination giving a gentle light. It was true that the illumination might not always be even, but he did not consider that this was necessarily a drawback. In the factory one needed an intense uniform illumination, but in the home one wanted something different. He thought that there was nothing ever produced so beautiful as the fittings characteristic of the XVI century and the Adams period. He could not imagine Louis XVI or Adams rooms being lighted with modern fittings. Whilst there was much of interest in modern methods of lighting he thought that, as so often occurred, there was a tendency to go too far. He hoped that members would afterwards have the pleasure of seeing a good selection of the beautiful series of pictures with which Mr. Penwarden had illustrated his paper.

Mr. G. ALISTAIR MACDONALD endorsed the views expressed by the last speaker, and expressed his agreement with the outlook of Mr. Thorpe. As Mr. Rawlings had said, in new departures people always tend to go to extremes. There were many modern designs of fittings that were merely fantastic and did not represent any definite advance. Whilst he did not wish to go back to the time of candles, he agreed that reading by candle-light was often soothing. Yet he could hardly use candles in a room treated according to modern methods. He did not quite understand why the last speaker had objected to the illuminated doorway, which seemed to him a legitimate device. He was much interested in the tubular lamp shown by Mr. Thomson, which could be used as a decorative element as well as a lighting agent; he had quite agreed with Mr. Penwarden that it was most important to differentiate between decorative lighting and the use of light as a decoration. The production of a decorative fitting was quite a distinct problem from the effect of the illumination of the room. He had been struck by many of the remarks

in Mr. Thorpe's contribution, and he hoped the day was coming when, he suggested, artificial lighting would be designed by the architect with the same care as he at present expended on the provision of access for natural lighting. Naturally, the aid of those in the electrical industry would always be necessary. They could afford valuable help in the designing of decorative schemes of lighting, provided that the two objects referred to above were kept clearly distinct.

Mr. B. B. BLACKBURN remarked that Mr. Penwarden's paper had suggested many new ideas, and gave an excellent impression of what was happening in connection with fixture designs. Some of the types shown were beautiful. He noticed that Mr. Penwarden had restricted his paper to developments in this country, but he thought it should, in justice, be said that experts in Germany, France, Holland and Sweden had been in the front in the development of architectural lighting fittings. He himself would not like to go back to the candle. Occasionally, when staying in country hotels, one had to put up with them, but in his experience reading in these circumstances was uncomfortable and bad for the eyes. He felt that the present age was full of possibilities for the future of lighting. Mr. Penwarden had dealt mainly with architectural lighting and decorative fittings, but domestic lighting was quite as important, and this was a field where there was also room for considerable progress. Our homes should be lighted by simple but well-designed fittings adapted to the purpose in view, instead of cheap copies of expensive and unsuitable types.

Mr. F. L. CALVERT referred to the problems involved in the use of candles and candelabra. In his opinion it was useless to try to adapt these antique designs to electric lighting. It was, as a rule, much better to remove such fittings and install a modern type. On such questions as this differences of opinion between the architect and the electrical engineer were almost bound to arise. It was largely a question of progress. He recalled when a child the singular procession of motor-cars, from which the modern type had developed. The present age was essentially a period of development, in buildings and furniture as well as lighting, and one should not be afraid of original designs merely because they seemed at first peculiar. As an instance of originality, he mentioned the *Daily Express* offices, which had been the subject of much comment. Such designs might or might not appeal to the eye, but there was no doubt that many of them had practical advantages and would endure.

Mr. A. CUNNINGTON expressed his appreciation of the paper. In the line of work in which he was primarily interested, railway lighting, there were not many opportunities for the use of expensive fittings. Engineers associated with railway companies were chiefly interested in the question of maintenance, and he was glad to see that this question had been put forward so emphatically in the paper. A railway lighting engineer had usually an immense number of fittings to maintain, and had to do this with a restricted staff. Maintenance, moreover, was often carried out by men who had other duties and were not specialists. It was therefore most important that fittings in general use should not be difficult to clean, and should not be easily broken. If these conditions were not complied with, installations—however striking they might be originally—were apt to deteriorate in the course of time. In this connection Mr. Cunnington referred to a lighting installation in a well-known building which had been described at one of the Society's meetings. He recalled his own original inspection of this installation, which was much admired. When, however, he had the occasion to visit the building again, about three years later, the condition of the lighting had become absolutely deplorable. The equipment had not been cleaned for a considerable time, and it was no longer an advertisement of which the illuminating engineer could be proud. Therefore, whilst they all desired fittings which were pleasing in form and beautiful to contemplate, it was absolutely necessary that they should be easy to manipulate and maintain, otherwise their original effect was quickly lost. He wished to thank the author for his carefully prepared and well-delivered paper—he thought one of the most delightful he had heard for a long time.

Mr. P. R. ALLISON said he observed with pleasure the desire of the Illuminating Engineering Society for co-operation with the architectural profession. In dealing with buildings of distinction it was easy to make a mistake if the architect was not consulted. He recalled a case in his own experience when he had designed the interior of a building in the Louis Seize period, and the client subsequently determined to arrange the illumination to suit his own wishes; electrical fittings in the Chinese style were adopted, and the effect was naturally deplorable. It might be of interest to mention that he had recently seen in Stockholm a building of international repute equipped with fine modern electrical fittings which had been most beautifully designed and finished by an Englishman. He confessed that, though he was not opposed to modern designs, he had a liking for period designs in interior decoration. Any design of this character, however, should be consistent. He thought that fuller co-operation between the fittings designer and the architect would certainly lead to more artistic productions.

Mr. A. G. BROWN thanked Mr. Penwarden for his paper, and made a few remarks on the engineering aspects of lighting. Previous speakers had referred almost entirely to the decorative side, and not much had been said about practical aspects. Mr. Penwarden had referred to the use of " an enlightened guess " in estimating illumination. He (Mr. Brown) agreed that one could not always calculate with precision the illumination resulting from any scheme, but one could by experience get a very good approximation. It was often possible, and advantageous even with decorative lighting, to standardise. For example, now that engineers were acquiring more knowledge of diffusing glass they could state definitely how far a lamp of given wattage could be placed behind a glass ornamentation in order to avoid a spotty effect. He mentioned this as an instance of the many opportunities for co-operation between the illuminating engineer, the fittings designers and architect.

The CHAIRMAN (Lieut.-Commander Haydn T. Harrison) expressed his interest in the paper. He had been particularly struck by what had been said in regard to candles and the candelabra, which he agreed were capable of very pleasing effects. He had himself had to deal with a number of the oldest homes in England. In every such case he had endeavoured to retain the original crystal candelabra, which appeared so exactly right from the decorative standpoint. In some cases as many as 180 or even 220 candles were used in a large fitting of this character, and he could not but think that this subdivision of lighting was an advantage. There were many old fittings of this type, and it was often possible to introduce electric candle fittings without incongruity. The general adoption of alter-

nating supply rendered this easier, because lamps of lower voltage and of smaller candle-power and dimensions could be adopted. He felt sure that Mr. Penwarden would agree with him that some of these lower-voltage lamps were very efficient. In his experience it was not usually desirable to use too white a light where decorative appearance was a consideration, and it was often expedient to encourage clients to be content with a somewhat lower efficiency in order to get the desired effect.

Mr. F. W. THORPE (*communicated*): Mr. Penwarden's able paper surveys a very wide field. He describes many efficient methods and emphasizes the advance in design of modern decorative lighting schemes. Have we at the same time advanced in the decorative design of the equipment necessary to give these effects? The result in many instances is good, but the chief claim of the methods employed appears to be novelty.

There is certainly a difference in modern lighting design, does this represent progress in the decorative side of the lighting scheme? Are the fragile semi-indirect pendants or brackets made up of sheet-glass panels with sharp spike edges of various odd shapes, with forked-lightning patterns etched on, an advance? Surely, not in lighting-fixture design, they are different—but that is another matter. From a maintenance standpoint they are a positive danger from falling glass, and to the person cleaning or replacing the lamps.

Perhaps it is not fair to select one branch of modern lighting, but there does appear to be a striving after mere originality and freakishness in designing the fittings in odd shapes, not altogether irrespective of their efficiency, but with little relation to sound design. We are substituting a mass of glass for the metalwork of the old electrolier. From the lighting standpoint the fixture and the lamp have improved in efficiency; do not let us condemn too quickly the old forms of lighting fittings, many of which were beautifully designed and made, and at the time fulfilled their purpose efficiently and well.

As Mr. Penwarden remarks, during this period the lamps were soft and almost without glare. The cost of current compelled designers to get the most out of the lamp, and delayed the introduction of what are known as modern methods. The advent of the gasfilled lamp, with its greater brightness, compelled designers to conceal the source from the eye. Lighting fittings design follows lamp development as well as architecture, and reduction in cost of current will also have an effect upon future schemes.

There appears to be a growing sharp division in the application of designs to various uses, domestic, commercial, shop and theatre lighting and lighting for public buildings. In the domestic field the individual fixture varying in shape and colouring appears to prevail in its endless variety; perhaps this is all to the good, providing they are designed on sound lines; many of these types will hold their own for some time to come. In commercial lighting the glass enclosed unit in various shapes appear at the moment to be standardized. In shop lighting and buildings for amusement where light is also used for novelty and attraction, decorative modern methods are applicable, and do give the designer and architect full play.

The striving for this modern effect is in many cases leading to very faulty construction, e.g., glass panels held by two or more screws through a hole in the glass, which extra pressure in cleaning would easily break, and they are very difficult to clean. Sound construction appears to be sacrificed too much to effect, and as Mr. Penwarden remarks in his paper, the maintenance is very difficult, and, I might add, perhaps forgotten.

Present-day illuminating engineers have demonstrated to the architect the many opportunities in the planning of the lighting as a part of the interior decorative plan. To be effective this should undoubtedly be designed by the architect on principles laid down by the illuminating engineer; it would help towards a better-unified scheme. I hope this development, which should restrain modern design, will result in better decorative equipment, whether the method is built-in or of fixture type. Will the architect in future plan his artificial lighting aperture as he plans his windows for daylight?

We should keep efficiency and economy in mind. I do agree with the author it is a danger to ignore maintenance in the struggle simply for novelty and effect; this will have to be considered, otherwise I feel the elaborate glass-panel equipment will be abandoned by the user—he has more light, but more work also. Whilst I agree with the author's view that modern lighting can be often applied to period rooms, there should be no objection to using adaptations of the old candelabras. It must be admitted many are masterpieces of design and workmanship, very beautiful, and, with all their defects, definitely preferred by many. We must not make a hard-and-fast rule, so long as the lighting gives decorative effect, is pleasing to the user, and in harmony with the surroundings.

Modern equipment appears to be based on the cube. Will the Continental designer next adopt the sphere, and shall we in the near future be designing modern decorative-lighting fittings based on circles, and persuading ourselves that we have made further progress in design because we have simply altered the basic form?

We have made progress in illumination, but have we in the decorative application of light? Will the "pack-of-cards" type of fixture collapse?

I wish I were able to be present at the meeting to see Mr. Penwarden's illustrations. Perhaps space will be found in the journal for as many as possible, however small.

I must add my congratulations to Mr. Penwarden for his very interesting and able paper, and his clear exposition of modern lighting practice, many examples of which are very beautiful.

Mr. E. H. PENWARDEN, in reply, expressed his appreciation of the kind reception that had been given to his paper. He noticed that many of the speakers who had contributed to such an interesting discussion, had enlarged on various phases of decorative lighting which were only briefly touched upon in the paper. As he explained at the outset of the paper, it was only possible to touch on the fringe of the subject. He had hopes, however, when preparing the paper, that the discussion afterwards would supplement the ground he had covered and help to fill in some of the many gaps that he had inevitably left.

He recalled that Mr. Bennett had emphasized the important part still played by the running cost in connection with schemes of decorative lighting. His own experience was that in the case of modern lighting, and especially in public buildings, there was now less tendency to attach great importance to the running cost of an installation. The cost of electricity had been diminished, and the increased efficiency of modern lamps also enabled consumers to obtain more lighting for a given expenditure. In many cases also the actual cost of an installation was of small moment in comparison with its value for purposes of publicity. It was realized, for example, by many large stores that the expenditure

on the lighting of their buildings was less costly, regarded as an advertisement, than advertising in the press. The design of dimmer to which Mr. Bennett had also referred was too technical a matter to be dealt with in a discussion of this character, but he might say that there were now available forms of dimmers which were not unduly expensive, and permitted gradual uniform variation of brightness. Mr. Bennett had also referred to the troubles caused by the accumulation of dust, which was liable to penetrate anywhere, and to the importance of easy access, so that decorative fittings can be readily removed and cleaned. He was in full agreement with Mr. Bennett and the other speakers who had emphasized this question of maintenance, and it was a fact that in many installations this vital matter was apt to be overlooked. Several speakers had remarked that modern methods seemed to arise from the mere desire for originality. This was no doubt true of a certain number of modern types of fittings, but one must remember that any real new design was apt to appear fantastic at first; he did not think it advisable to limit designers too much to the application of purely decorative principles or established traditions in regard to decorative effects. Whilst it was true that many of the designs of the Adams and Louis Seize periods were exceptionally pleasing, it did not follow that it was wrong to embark on quite new ideas. If one followed too exactly the justly admired designs of the past there would be no progress. We should remember also that the modern interior was a new thing, and if one experimented with the structure there seemed no reason why one should not embody luminous-glass designs into the general scheme, provided they harmonized with the surroundings.

Some reference had been made to mass production of fittings. Generally speaking, such methods should only be applied to designs of unquestionable merit. If a large number of fittings of approved type are being produced, greater care should be taken to assure that the fundamental design is a good one. He had listened with great interest and with some sympathy to the views expressed in the contribution from Mr. Thorpe, whose paper before the Society had formed a starting point for his own discourse. In some degree he shared the feeling expressed by him and Mr. Rawlings that the good things of the past should not be forgotten. Nevertheless, as he had said previously, one should not discourage those who were disposed to experiment in new directions. It usually took a long time for people to appreciate fully anything that was new, and also to determine whether the novelty had sufficient merit at the back of it to enable it to survive.

In conclusion, Mr. Penwarden again thanked the Chairman and the various speakers for their reception of his paper.

A Photoelectric Photometer

In *Die Lichttechnik*, the journal of the Austrian Illuminating Engineering Society, S. Strauss recently described a form of direct-reading photometer (the "Licht-Mekapion") based on the use of a photoelectric cell. The nature of the electric circuit is illustrated and a general view of the apparatus is shown. The electric equipment, the cell, and the galvanometer are here shown as separate elements interconnected with flux. A form of recording apparatus, suitable for tracing variations in daylight on a recording drum, is also illustrated. The author refers to the varying sensitiveness throughout the spectrum of various types of cells. Thus the potassium cell is well suited to the measurement of daylight; caesium cells are too sensitive in the red and infra-red, whilst cadmium is mainly sensitive to ultra-violet.

The Work of a Public Lighting Department

(Proceedings at a Joint Meeting of the Illuminating Engineering Society and the Association of Public Lighting Engineers, held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C.2, at 6-30 p.m., on Tuesday, May 24th, 1932.)

A MEETING of the Society was held in the lecture theatre of the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C., at 6-30 p.m., on Tuesday, May 24th. In the absence of the President, the chair was taken by Lt.-Commander HAYDN T. HARRISON (Vice-President), who expressed his pleasure in presiding over a Joint Meeting with the Association of Public Lighting Engineers.

After the minutes of the last meeting had been taken as read, the HON. SECRETARY read out the following names of applicants for membership:—

Corporate Members:—

Eastman, R. .....Electrical Engineer, The Edison Swan Electric Co. Ltd., 15, Hillside Road, Wallasey, Cheshire.

Henshaw, J. M. .....Illuminating Engineer, The Edison Swan Electric Co. Ltd., Spylaw Bank Road, Colinton, Edinburgh.

Pryor, H. A. .....Branch Manager, Siemens Electric Lamps & Supplies Ltd., Moss Bank, Worsley Road, Swinton, Manchester.

Sawyer, K. F. .....Assistant, Photometric Laboratory, The Gas Light & Coke Co. 12, Mafeking Road, Enfield, Middlesex.

Spencer-Johns, D. .....Illuminating Engineering Department, The Edison Swan Electric Co. Ltd., 2, Sir Harry's Road, Edgbaston, Birmingham.

Steele, A. ... .Branch Manager, Siemens Electric Lamps & Supplies Ltd., 27, Cadogan Road, Glasgow.

Varcoe, Thos. H. .....Branch Manager, Siemens Electric Lamps & Supplies Ltd., Siemens House, 9, Albert Street, Birmingham.

The Hon. Secretary then read again the names of the applicants presented at the previous meeting, and these gentlemen were formally declared members of the Society.*

The CHAIRMAN then called upon Mr. E. MARRISON to present his paper on "The Work of a Public Lighting Department," which was illustrated by lantern slides, and contained a detailed description of the organization of the laboratory and workshops of the Public Lighting Department of Sheffield. Mr. Marrison also explained the nature of their work, and the method of carrying out inspections, repairs, and testing of installations and the preparation of plans for new work.

The paper gave rise to an interesting discussion, in which the following, amongst others, took part: Mr. E. J. STEWART, Mr. J. S. DOW, Mr. J. F. COLQUHOUN, Mr. A. CUNNINGTON, Mr. C. A. MASTERMAN, Mr. H. C. BROWN, Mr. E. STROUD, Mr. W. J. JONES, Mr. G. H. WILSON, Mr. J. M. WALDRAM and Mr. P. P. WHEELWRIGHT.

After Mr. MARRISON had briefly replied to the discussion a cordial vote of thanks to the author for his paper and to the E.L.M.A. Lighting Service Bureau for their hospitality was proposed by the CHAIRMAN and carried with acclamation.

* *The Illuminating Engineer*, May, 1932, p. 132.

Public Lighting as a Measure of Safety and as an Aid to the Guidance of Traffic

A PAPER compiled by the aid of various members of the Association of Public Lighting Engineers was presented by Mr. Harold Davies (Vice-President) at the National Safety-First Congress (1932), held in the Caxton Hall, Westminster, on May 5th.

In his opening remarks Mr. Davies recalled the paper read by Mr. R. Beveridge before the 1930 Congress in Liverpool, and the resolution passed by the London Safety-First Council in 1919, affirming the desirability of including information on lighting conditions amongst official data on street accidents. Mr. Davies remarked that the original main function of public lighting—i.e., preventing citizens from being robbed and molested—had recently become of importance. Assaults and robberies seem to occur most frequently in side streets and squares that are relatively poorly lighted. But the dominant consideration is a later one, imposed by the great growth of motor traffic and the resulting dangers of the streets.

Public Lighting and Public Safety.

The number of street accidents tends to increase year by year, in spite of energetic "safety-first" methods. Roads tend to become less safe for the user, especially the pedestrian. Roughly 1½ million people have been killed or injured on the roads since the termination of the war—a number equal to more than half the British casualties in the field. Methods of presenting statistics do not usually enable one to distinguish between accidents occurring by night and by day. But various special enquiries have shown the importance of lighting conditions in relation to safety at night. It is significant that the proportion of accidents occurring by night seems to be progressively increasing. Mr. T. W. Rolph has put forward the belief that about 130,000,000 dollars lost annually through traffic accidents, burglary and theft in the United States might be saved by really good public lighting, such as could be furnished by an expenditure of 2.50 dollars *per capita*—say 75,000,000 dollars for the entire country. On this basis the annual saving would pay for nearly double the expenditure needed. An equally good case might doubtless be made out for public lighting in this country.

Mr. Davies expressed the hope that the National Safety-First Association would be able to help in the task of obtaining detailed statistics showing the benefits of street lighting, luminous traffic-control signals, and other devices in which light is applied in the interests of safety. He quoted the following instructive figures from the records included in a memorandum issued by the Chief Constable of Edinburgh:—

Year	Number of Accidents
1926	1,801
1927	1,336
1928	1,089
1929	1,038
1930	996
1931	937

The number of accidents is thus apparently only *half* that recorded in 1926, when the Traffic Department was inaugurated in Edinburgh. The report also contains a list of ten methods which have contributed to this reduction. One-half of these measures is definitely associated with public lighting, namely:—

The installation of traffic-control signals at street intersections.

The installation of gyratory and semigyratory traffic control.

The erection of "Drive Left" and "Turn Left" lamps and signs.

The improvement of street lighting at road junctions.

The lighting of street obstructions, such as tramway islands.

It is naturally difficult to trace the effects of these measures individually, but in one case—the installation of traffic-control signals—records have been kept at the seventeen crossings at which light signals were applied, and with the following striking results:—

Year	Persons Killed	Persons Injured	Collisions without Injury to Persons
1928	2	41	159
1929	2	14	108
1930	1	14	78
1931	–	10	72

Before passing on to other problems, Mr. Davies quoted the experience of authorities in Sheffield, Eastbourne and other cities, where it had been found that better lighting and the use of luminous signals, notices, etc., have aided public safety and brought about economies. Mr. I. H. Massey, of Oldham, has attacked the problem in another manner by comparing the "traffic risk" in various thoroughfares with the actual number of accidents recorded during the lighting period. For a given traffic risk the number of accidents was, generally speaking, least in those streets falling in the higher classes of lighting according to the British Specification.

Problems in Street Lighting.

Turning next to problems in street lighting, the author pointed out first the very moderate nature of present requirements. With the exception of the lighting of coal mines, there is probably no field of lighting where performance lags so far behind our desires. Streets lighted according to the Class "A" standard (2 foot-candles) are practically non-existent, and even Class "B" streets (1.0 foot-candle) are regarded as quite exceptionally well-lighted. Yet this "B" illumination is only 1/20th of that considered necessary for fine industrial work, and actually 1/500th of the average unrestricted daylight illumination out-of-doors.

Street lighting, moreover, is subject to other inherent difficulties. Lamps are commonly spaced far apart. Objects on the roadway are illuminated only by isolated and distant sources, so that their outlines rather than their shapes can be seen. The modern dark-coloured road surface is a very difficult one to illuminate. A dominant consideration should be the avoidance of abrupt contrasts in brightness and shadow, but the highly polished surface of the roadway is liable to give rise to confusing "splashes of light" in the form of direct reflections of light-sources. Inequalities may also occur as one passes from a main street to a side street—not because the former is extravagantly lighted but because the illumination of the latter is inadequate. If this illumination cannot be brought up to the desirable value the transition should be rendered gradual by increasing the illumination as the main road is approached. Similar contrasts may arise when a road passes through the areas of different authorities. The peculiar location of boundaries also gives rise to dangerous contrast, e.g., when the boundary terminates at important cross-roads and the motorist passes from the good lighting of a city into com-

parative darkness. Such anomalies may be lessened by concerted action between the two authorities.

Much care has been devoted to the design of directive and diffusing lanterns, but some degree of glare is almost inevitable if moderately even illumination is attempted with the present wide spacing of lamps. The use of opaque reflectors with a sharp "angle of cut-off," so as to screen lamps from view, has been suggested; but, if carried to a logical conclusion, it is apt to give rise to patchy illumination as well as darkening unduly the faces of buildings. Motorists, too, derive some guidance from visible lights along the roadway. On the whole, opinion favours the use of visible light-sources of mild brightness, mounted at the desirable minimum height. Useful guidance on this point is given in the most recent edition of the British Standard Specification for Street Lighting.

The Value of Contrast.

Contrast, though undesirable in excess, may be judiciously applied to render objects on the roadways more easily visible. Experiments in Leicester and other cities have shown that it is a great advantage for officers on point duty to wear white coats, or at any rate white helmets and gauntlets. Special spotlights affording extra illumination at busy crossings are also useful. In cases where an area is already strongly illuminated an amber-coloured beam directed on the figure of the pointsman is a helpful device. In dangerous areas would it not be possible for the kerb or extremity of the footpath to be distinguished by a white coating?

The importance of adequate lighting on rural highways and arterial roads has frequently been emphasized. On such roads the use of headlights is doubtless a recognized necessity, but in the case of well-lighted streets in cities their use is unnecessary and inexpedient. (It has been suggested that their use should be discouraged, or even forbidden in streets lighted up to a certain standard.) Amongst other points in connection with lighting equipment Mr. Davies mentioned the disconcerting shadows liable to be caused by loosely suspended lamps swinging in the wind; good rigid support is desirable to remove this difficulty. Lamps partially screened by the foliage of trees may produce the same effect. Whenever there are trees planted at the roadside the lamps should be brought well out into the middle of the roadway. The importance of maintenance is evident, as the failure of a street lamp may prove highly dangerous. Failures after hours should be reported to a special official, and certain fitters should be available throughout the night so that failures in recognized danger spots can at once be remedied.

Luminous Traffic Signals.

Luminous traffic signals have now proved their value. The design is now becoming completely standardized, and it seems to be accepted that the best position for signals is at the edge of the footwalk. In the interests of the safety of pedestrians a minimum period of three seconds for the amber signal has been suggested; on exceptionally wide crossings four to five seconds would not be excessive. Adequate warning that traffic signals are being approached should be given; in some cases the distance from the warning signals to the traffic signals is too small.

Progress has also been made in the standardization of direction signs and warnings of various kinds, which are being more and more widely used. Such signs are becoming equally necessary by night and by day, and wherever possible they should be adequately illuminated. Official guidance on dimensions and design is now afforded. Might not some simple hints on methods of illumination also be given, so that the signs may be evenly illuminated to a sufficient intensity and by concealed sources free from glare?

In the final section of the paper Mr. Davies expressed the general desire for closer relations with the National Safety-First Association. Adequate public lighting is one of the strongest influences in promoting public safety—yet progress is not nearly so rapid as one could desire. Authorities are disposed to economy and apprehensive of additions to the rates. In the long run, therefore, it is to enlightened public opinion that one must look for aid in bringing about improvements. What is chiefly needed in order to carry conviction is reliable statistical information showing the benefits of public lighting in promoting public convenience and security. Co-operation between the two Associations should help in this direction. It is also suggested that, as a matter of practice, the public lighting engineer (or equivalent official) in each area should be invited to act on the local Safety-First Committee.

DISCUSSION

The CHAIRMAN (Sir Arthur Johnson) referred to the unavoidable absence of Sir Henry Maybury, who had hoped to be able to preside. The paper should prove of great interest to engineers throughout the country, and he hoped that it would lead to a good discussion.

Mr. R. BEVERIDGE (Edinburgh) recalled a recent discussion in the House of Commons, when it was declared that economy must not be exercised to the detriment of the public health. He wished he could feel sure that there was a similar recognition of the importance of maintaining public safety. There was a special service to care for public health which had attained great dimensions, so that to-day the nation could get relief, literally from the cradle to the grave! On the other hand, accidents were dealt with not by one but by many departments, so that the Government could not speak with one voice on the subject of safety as it could in regard to public health. He wished to express his appreciation of the paper, which he hoped would help to establish the intimate relation between public lighting and public safety.

Mr. THOS. WILKIE (Leicester) also expressed his interest in the paper. The point that he chiefly wished to emphasize was the great opportunity presented for co-operation between the A.P.L.E. and the National Safety-First Association. He hoped that sympathetic consideration would be given to the proposal in the paper that the local Safety-First Council and public lighting engineers should work together.

Mr. C. C. PATERSON contrasted progress in street lighting with advances in other directions, for example in the factory and in the home. In both cases the general standard had been advanced to a remarkable extent during the past 50 years. The improvement in public lighting, so far as intensity and expenditure were concerned, was incomparably less, and little had been done to render it more cheerful and attractive. It was quite a mistake to imagine that public lighting was unduly costly, as one of the speakers at the recent Transport and Public Works Congress seemed to think. The lighting of the Victoria Embankment, to which that speaker had referred, was not unduly expensive and certainly not extravagant, bearing in mind the traffic which this thoroughfare now carried. He would like to bring home a second point, namely, that not only must the illumination be adequate but the

nature of the road surface should be, if possible, better adapted to enable the illumination to have a useful effect. He understood that surveyors and civil engineers were interested in the problem. If a lighter material could be used one could get a much greater brightness for a given expenditure. The effect would then resemble more nearly that found in interior lighting—where dead-black surfaces would never be contemplated.

Dr. J. W. T. WALSH referred to the comments in the paper on the effect of "angle of cut-off." He did not think that such devices need give rise to a patchy illumination if combined with a suitable directive device. The mounting height was of considerable importance, and should not be less than 13 ft. above the roadway. The nature of the road surface, to which Mr. Paterson had drawn attention, was an important point. Experiments were now being made with cement-spraying and other methods of treating the surface of the road, and with white-washing kerbs. Spraying with light-coloured cement might effect a material and lasting improvement. Possibly a light-buff colour might prove preferable to white. Money applied to research on this problem might lead to substantial economies and was well spent.

Mr. J. F. COLQUHOUN (Sheffield) commented upon values in the B.E.S.A. Specification, which, as Mr. Paterson had remarked, did not call for extravagant values. The illumination prescribed in the lowest class ("H") was so very low that some people thought it hardly worth while specifying—yet there were thousands of miles of streets that did not reach even that low standard! The presence of glare was doubtless a harmful element in street lighting, but unfortunately there were many people who did not realize this. There were, as the paper indicated, many methods of lessening glare. Probably the safest and most widely applicable was the adoption of greater mounting heights. He wished to endorse what had been said in regard to providing attendance after lamps had been lighted up. In Sheffield they had arranged to have some of the staff on all-night duty, but they also obtained considerable help from the police. Motorists were still apt to insist on using dangerous headlights, even in streets that were quite adequately lighted. He hoped that the National Safety-First Association would be able to do something to check this evil. He welcomed the suggestion that public lighting engineers should co-operate with local Safety-First Committees, and hoped that the suggestion thrown out in the paper on this subject would be acted upon.

Captain W. J. LIBERTY expressed the hope that the National Safety-First Association would be able to obtain statistics of the type mentioned in the paper. The Ministry of Transport were experimenting with a variety of types of concrete surface on one of the new by-pass roads, though he believed that coloured materials were not yet being tried. There was no doubt that the nature of the surface was of great importance in relation to lighting. He recalled a road in Dulwich so dark and highly polished as to give the impression almost of having been blackleaded! Walls were not infrequently damaged by cars skidding on such surfaces. At the present time it was almost hopeless to try to induce local authorities to install new systems of lighting. There were, however, methods of making conversions of existing fittings and increasing the mounting height, costing approximately 4s. a point. In many cases the mere substitution of modern lamps and more efficient burners would substantially increase the available illumination.

Capt. J. H. TRYE (Cheltenham) remarked that the application of light-coloured chippings to the surfaces of roads effected a great improvement and was inexpensive. The effective lighting of wet road surfaces was very difficult. Care should be exercised to prevent casual lights (such as those attached to petrol stations) being confused with traffic signals. Red and green lights should be strictly confined to traffic signals, which, however, were sometimes too high up, so that motorists could not see them without taking their eyes off the road.

Mr. B. J. BELSHER (Stepney) remarked that in Stepney the overhead lamps had been removed and replaced on tramway standards. The lighting was controlled by clockwork, so that it required special organization to provide for replacement of isolated lamps that failed at night. He did not think that very light road surfaces, which were trying to the eyes, were necessary. As an alternative he suggested that the fronts of vehicles should be light in colour and illuminated.

Councillor W. PREYE (Edmonton) remarked that the lighting of arterial roads frequently proved to be a formidable and expensive task for local authorities. He certainly thought that the Ministry of Transport ought to provide for the lighting when making such roads—especially as the expense would be less if the work was done under these conditions. If borough councils were asked to do so subsequently it ought at least to be possible for them to obtain assistance from the Ministry of Transport without a protracted enquiry.

Mr. L. C. HANSEN (Transport and General Workers' Union) remarked that people seemed to be under the impression that street lighting was provided for the benefit of the motor-driver only. It would be more correct to say that it was only for pedestrians. Existing methods of street lighting were frequently a danger to motorists, who did not want high illumination of the road surface, but instead the outlining of boundaries and better methods of distinguishing corners.

Sir FRANK BEAUCHAMP (Somerset County Council) agreed that dark road surfaces had much to do with complaints of poor lighting. The Ministry of Transport had spent much money on experiments with road foundations and anti-skidding surfaces. Could they not be induced to experiment with materials of lighter colour? In country districts the lighting was often very primitive. The whitening of kerbs would be of great help to motorists, but some material which would remain white was needed.

Miss C. N. BOYLE (Pedestrians' Association) supported the contention that roads should be surfaced with lighter material. The minimum period suggested for the amber signal was of great importance. Could not the Association get an understanding that no traffic whatever should move whilst the yellow signal was showing, so that pedestrians would have a fair chance of crossing the road?

The CHAIRMAN, in winding-up the discussion, expressed his belief that problems involved in the lighting of arterial roads should be solved by co-operation between the local authorities interested. He deprecated the creation of a central supervising authority. He wished to endorse what had been said in the paper in regard to the desirability of having, in towns and cities of any size, an independent official as public lighting engineer, and also wished to emphasize the great importance of maintaining an all-night staff to deal with casual failures of lights. He agreed that direction signs and signals were sometimes incorrectly placed, and urged that more care should be taken to prevent them being masked by adjacent signs of an advertising character.

Mr. HAROLD DAVIES, in reply, said that he could only deal briefly with a few of the many topics discussed. He felt that he could not cross swords with

Dr. Walsh by entering into detailed analysis of the technical problems involved in the "angle of cut-off," but he thought it was generally recognized that *complete* masking of lights from view was difficult to achieve without causing wide variations in road illumination. Many speakers had followed Mr. Paterson in commenting on the need for lighter road surfaces. It was at present difficult to get a material which would result in a *white* road, but moderately light surfaces were practicable. Surveyors could usually get suitable material from outside sources; he had found light-yellow gravel grit of great help in assisting visibility. The problem of meeting expenditure on the lighting of arterial roads was a familiar one. It might not always be feasible to determine the lighting arrangements at the time a road was constructed. Municipal authorities had sometimes been granted loans by the Ministry of Transport, and he certainly thought that aid should be forthcoming in cases where little advantage was gained locally. Whilst not suggesting that all signs should be of standard design, he did think that certain common principles should be adopted so that everyone would recognize their nature. He hoped that the National Safety-First Association would be able to help them to get fuller information on night hazards and the relation of lighting thereto, and he wished to recommend especially the proposal that public lighting engineers should be invited to act on the local Safety-First Committees in their districts.

Mr. S. B. LANGLANDS (Glasgow) briefly proposed a vote of thanks to Sir Arthur Johnson for presiding and to Mr. Harold Davies for the paper. He recalled that the law of public lighting in Scotland contained an injunction that all thoroughfares should be well and thoroughly lighted!

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

(*Continued from Page* 134, *May*, 1932).

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. L. J. Collier, Mr. H. M. Cotterill, Mr. J. S. Dow, Dr. S. English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. J. M. Waldram, Mr. W. C. M. Whittle and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

I.—RADIATION AND GENERAL PHYSICS.

119. The Colorimetry of Point Sources. J. E. Desrivieres.

Rev. d'Optique, 10, *pp.* 389, 404. *October*, 1931.

The ordinary laws of colorimetry are not applicable to point sources of light. The author describes experiments in which a source of this nature is compared with an artificial point source viewed from a distance of about 30 metres. The spectral composition of this latter source can be varied at will by the observer. The author's conclusions, based on the observations of about fifty observers, are:—

(1) The hue of a point signal varies with the flux reaching the observer's eye, and hence with the distance of the signal from the observer.

(2) At each part of the spectrum there is a threshold of perception, and this is affected if it is seen in conjunction with a differently coloured source.

(3) At extreme ranges the blue of a signal is imperceptible.

The effects of departure from normal vision are examined. The author proposes a new method of examining point sources of light to obtain information as to the relation between spectral composition and visibility. L. J. C.

120. On the Constitution of the Oxide in Rectifiers Photoelectric Cells of the Copper Oxide type. Leon Dubar.

Comtes Rendus, 194, *pp.* 1332-1334. *April* 18*th*, 1932.

The author distinguishes between two forms of oxide, one of medium conductivity and the other of very low conductivity, which varies with the illumination of the oxide. Several methods of analysis were employed to compare the two oxides, and conclusions are drawn as to the nature of the matter producing the increase in the conductivity of the one type. S. S. B.

121. Molecular Scattering of Light in Solid Bodies; an extract from "The Theory of Scattering of Light." M. Leontowitsch and S. Mandelstam, junr.

Phys. Zeits of the Soviet Union.
Zeits.f.Phys., 75, *pp.* 350-355, 1932.

A theoretical formula is given for the relative intensity of light scattered in crystals of cubic symmetry (rock-salt) and for that scattered in isotropic solid bodies. The latter expression differs from that obtained by Gans (Ann.d.Phys., 77, p. 313, 1925). While the theoretical results agree with experiment for the relative scattering in rock-salt and quartz, there is a discrepancy when comparing Na Cl with quartz. T. H. H.

122. Temperature Crests in Cando - luminescence. E. L. Nichols and H. L. Howes.

Jour. Opt. Soc. Am., 22, *pp.* 170-189, 1932.

The existence of definite maxima in the brightness-temperature curves of rare earths when heated in the hydrogen flame is shown. The position of these crests depends upon the nature of the rare earth. At the crests the luminescence is frequently many times higher than that of a black body at the same temperature. When a trace of an activator such as Gadolinium, Neodymium or Samarium is added to one of the rare earths, the luminescence at those crests which remain is greatly enhanced. The view is suggested that the positions of the crests are at the temperatures at which structural alterations in the substance occur. T. H. H.

II.—PHOTOMETRY.

123. National Physical Laboratory Annual Report for the Year 1931.

H.M. Stationery Office.

PHOTOELECTRIC PHOTOMETRY (p. 154).

Work on photoelectric photometry has been chiefly concerned with the photoelectric cells themselves and with the development of a means for obtaining a satisfactory photoelectric reproduction of the spectral-sensitivity curve of the human eye. Reference is made to the use of the electrometer and thermionic-bridge photometer, and to an investigation into a suitable photoelectric cell and filter combination for photometry. A photoelectric daylight recorder has been working continuously throughout the year. A photoelectric method has been used on several occasions for the measurement of the transmission of optical systems.

HETEROCHROMATIC PHOTOMETRY.

Spectrophotometry. The spectrophotometer has been improved by the provision of specially designed symmetrical slits.

Determination of the Transmission Factors of Coloured Lenses. Work has been done on the determination of the transmission factors of coloured lenses used in railway signals, and the results have been communicated to the British Standards Institution.

PHOTOMETRIC STANDARDS (p. 156).

Primary Standard of Light. As recommended by the Comité Consultatif d'Électricité in 1930, experiments are being made on a black body set up in accordance with a specification prepared by the Bureau of Standards. The specification refers to the use of a black body at the freezing-point of platinum as a primary standard of light, the method of heating being by electromagnetic induction. Twenty-five melts and twenty-five freezes covering a fairly wide range of heating have been observed. A range of about 3 per cent. in the values was obtained for the brightness of the black body at the freezing-point; with the platinum melting the brightness appears to be about 1 per cent. lower than at the freezing-point. The apparatus is being modified with a view to reducing the range of the values obtained for the brightness. By means of a carbon-tube-vacuum furnace it is hoped to determine the brightness of the radiation directly in terms of the laboratory photometric standards.

International Comparison of Photometric Standards. Reference is made to the inter-comparison of the values of the transmission of four blue glasses used in conjunction with carbon filament lamps at a colour temperature of 2080° K., and to the conclusions which were presented to the general session of the International Commission on Illumination. An inter-comparison is also in progress—using carbon-filament lamps—between the American, French, German and British national laboratories.

W. B.

124. Photometry by Means of Sperrschicht Cells.

Licht u. Lampe, 9, *p.* 131, 1932.

Compares a copper-oxide and a selenium sperrschicht cell for use in photometry. Concludes that the two cells are equivalent in linear proportionality, colour sensitivity and temperature sensitivity, but that the selenium cell has greater sensitivity, but also greater inertia. E. S. B-S.

125. An Amplifying Photoelectric Photometer for the Measurement of Low Illumination. G. Rougier.

Comtes Rendus, 194, *pp.* 1319-20, *April 18th*, 1932.

The photometer employs a gasfilled potassium cell and two grid-amplifying valves. Diaphragms shield the cell from stray light and control the field of view. By suitably adjusting the four variables, filament current, plate potential, cell potential and diaphragm aperture, values between 1 lux and 0.001 lux may be measured easily to an accuracy of 0.5 per cent. S. S. B.

126. Photronic Cell a Direct Aid to Better Lighting. A. H. Lamb.

El. World, 99, *pp.* 692-694, *April 16th*, 1932.

Describes various applications of the new "photronic cell," giving curves and photographs. The spectral-response curve of the cell is stated to resemble closely that of the eye. W. C. M. W.

III.—SOURCES OF LIGHT.

127. The Burning-out Process of Vacuum-lamp Filaments. II. L. Prasnik.

Zeits.f.Phys., 75, *pp.* 417-420, 1932.

This is a continuation of a previous paper (Zeits. f. Phys., 72, 1931). The life of a tungsten filament is shown theoretically to be a function of the temperature at which it is run, and also to depend very largely upon the initial variations in its diameter.

Two tables and a graph are shown in order to illustrate the behaviour of the rather complicated theoretical expressions. T. H. H.

128. Neon-tube Lighting. Anon.

El. Rev., 110, *p.* 593, *April 22nd*, 1932.

Various gases are used besides neon in discharge-tube lighting, the chief of these being mercury and helium. The tubes need a high initial striking voltage, but this drops as soon as the tube is alight. The tubes are very penetrating, and in addition to use for advertising they are suitable for aerodrome lighting where they penetrate far. G. H. W.

129. Gaseous-discharge Tubes. S. Bennis.

Electrician, 108, *p.* 564, *April 22nd*, 1932.

An abridged article from the *N.E.L.A. Bulletin* for February. The author discusses recent progress and touches upon the combination of two or more tubes of different colours. Applications to which these tubes are particularly suited are discussed. An instance is given of a windowless factory utilizing fittings formed by the combination of a Cooper-Hewitt tube with four 75-watt incandescent lamps. Such units are arranged with a 14 ft. × 20 ft. spacing, and an illumination of 28 foot-candles is obtained. The equivalent of outdoor radiation is obtained by the ultra-violet radiation from the fittings.

C. A. M.

V.—APPLICATIONS OF LIGHT.

130. Trends in Lighting. A. E. Iliffe.

El. Rev., 110, *pp.* 699-700, *May 13th*, 1932.

In this article the importance of physiological and psychological factors in obtaining good lighting is stressed. The value of light is in providing contrast for the eye to see, and adequate visibility is dependent on this contrast. Logically, therefore, light efficiency should be judged on a millilambert rather than a foot-candle basis.

The article is illustrated by photographs of good and bad lighting. G. H. W.

131. How Much Light Does the User Want? M. Luckiesh.

El. World, 99, *p.* 787, *April 30th*, 1932.

Describes a test to determine the amount of light considered desirable by different observers for normal purposes. It is concluded that "the user has an insatiable appetite for light." W. C. M. W.

132. Saving Youthful Eyes. Anon.

El. World, 99, *p.* 651, *April 9th*, 1932.

Describes an "eye-conservation room" in the new Public School in Jersey City, N.J. Special fittings are used, providing a general intensity of 30 foot-candles. Photoelectric control is used.

W. C. M. W.

133. Where is Europe Leading Us in Home Lighting? B. Bowser.

Am. Illum. Eng. Soc., Trans., 27, *pp.* 385-395. *April*, 1932.

The paper presents a brief review of some of the most recent developments in architectural built-in lighting and in modern home lighting equipment now in use in England, France and Germany, supplemented by illustrations showing a number of typical installations. G. H. W.

134. Home Lighting in America as seen by the Architect. D. J. Baum.

Am. Illum. Eng. Soc., Trans., 27, *pp.* 396-400, *April*, 1932.

The author stresses the need of lighting fixtures in expressing and interpreting the proper applications of illumination in the home as visualized by an architect. Several installations illustrating various points brought out in the paper are shown.

G. H. W.

135. Home Lighting in America as seen by the Decorator. P. T. Frankl.

Am. Illum. Eng. Soc., Trans., 27, *pp.* 401-2, *April*, 1932.

A short paper putting forward the view of an interior decorator on the subject of home lighting, in which he attempts to show the difference between the use of light for purely utilitarian purposes and its application as a medium of decoration. G. H. W.

136. Light and Architecture.

Am. Illum. Eng. Soc., Trans., 27, *pp.* 347-360, *April*, 1932.

After a contribution on the subject of light and decoration, thirteen illustrations, with descriptions, are given of modern lighting installations in America. G. H. W.

137. Significant Lighting in Department Stores. J. L. Stair.

Am. Illum. Eng. Soc., Trans., 27, *pp.* 361-384, *April*, 1932.

Several interesting examples of lighting applications in department stores are presented with a view not only of indicating the trend in this rapidly expanding field, but also of suggesting the opportunities that exist for the illuminating engineer in assisting to create a dramatic background against which merchandise is displayed and sold. G. H. W.

138. Lighting Aids Paper Inspection. Anon.

El. World, 99, *p.* 699, *April 16th*, 1932.

A row of lamps is used to facilitate inspection and detection of flaws in paper passing over rollers at 450 feet per minute. W. C. M. W.

139. Safety Lighting in Cinemas. "Battery."

El. Rev., 110, *p.* 698, *May 13th*, 1932.

According to regulations under the Cinematograph Act, two separate sources of lighting are required in every cinema.

The safety lighting may be supplied in four ways: (1) by gas, (2) supply from two separate companies, (3) crude oil generator set, (4) trickle-charged battery kept charged from the mains.

The author deals with the advantages and disadvantages of each of these systems. G. H. W.

140. Pre-set Lighting Developed for Ten Theatre Scenes. Anon.

El. World, 99, *p.* 617, *April 2nd*, 1932.

The colour combinations and intensities required for ten successive scenes may be pre-set, and operated when desired by means of two simple controls, giving either a gradual or a sudden change from one combination to the next. Thermionic-tube control is used. W. C. M. W.

141. The Shakespeare Memorial Theatre. Anon.

Elect., 108, *p.* 570, *April 22nd*, 1932.

Details are given of the complete lighting equipments of the Shakespeare Memorial Theatre at Stratford-on-Avon. C. A. M.

142. Lighting in Piccadilly Circus. Anon.

Elect., 108, *p.* 571, *April 22nd*, 1932.

A description is given of a new system of combined street lighting and floodlighting at Piccadilly Circus.

C. A. M.

143. New Sign at Trafalgar Square. Anon.

Elect., 108, *p.* 545, *April 15th*, 1932; *and p.* 574, *April 22nd*, 1932.

Particulars, with a photograph, are given of a new cold-cathode sign installed in Trafalgar Square. The site covered measures 110 ft. × 40 ft., and the sign is the largest of its type in the British Isles. It is controlled by a photoelectric cell. C. A. M.

VI.—MISCELLANEOUS.

144. National Physical Laboratory: Annual Report for the Year 1931.

H.M. Stationery Office.

In addition to the photometric work summarized on p. 157 (No. 123), this report summarizes various special investigations on illumination, namely:—

Fundamental Research on Glare and Visual Capacities (p. 159). Under this heading reference is made to the effect of glare on brightness difference threshold, with white light and with coloured light.

Glaremeter. A description—accompanied by a sectional view—of a second experimental glaremeter is given on p. 161.

Miscellaneous. Other work (pp. 161-166) carried out under the guidance of the Illumination Research Committee of D.S.I.R., to which reference is made in the report, include the following:—

Skylight Illumination; Daylight Factors in Deep Rooms; Precision Tests on Portable Photometer; a Standard Precision Illuminometer; a simple Portable Photometer; Illumination of Light-wells; Diffusing Glassware; The Effect of Position of Source in Enamelled Steel Reflectors; Motor-car Headlights and Dock Lighting. W. B.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

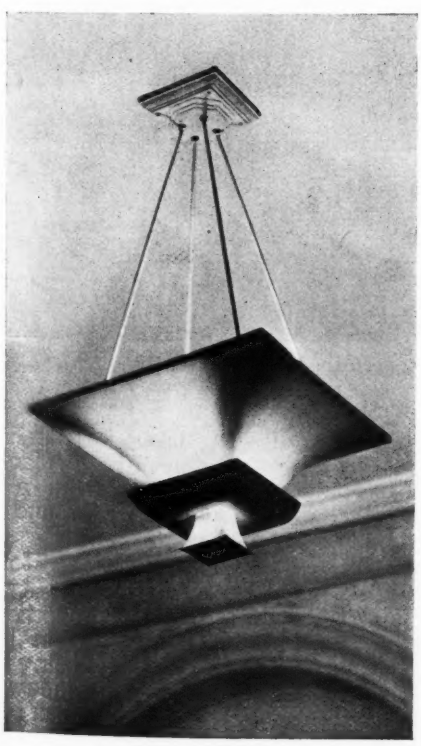
(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

The 25th E.L.M.A. Illumination Design Course

The illumination design course which took place at the E.L.M.A. Lighting Service Bureau during May 2nd-5th, the twenty-fifth of the series, served as a distinct landmark. We understand that over 100 representatives of electric-supply undertakings. contractors and manufacturers took part in the course, and it is surely remarkable how the attendance is maintained and even extended year by year. The aggregate number of those who have gone out into industry from it with new insight into the possibilities of modern lighting must be considerable. One notices also that the number of those who can be drawn upon to give lectures is continually increasing. There were apparently 15 different lecturers responsible for the 23 addresses mentioned on the programme. As usual, these talks roved over a wide range of subjects, amongst which may be mentioned "Twenty Years of Scientific Illumination" (R. C. Hawkins), "Light and Vision" (W. J. Jones), "Factory Lighting Design" (T. Catten), "Shop Lighting Design" (E. B. Sawyer), "Industrial Lighting" (S. Anderson), "Lighting for Large Offices" (F. Marsh), "The Development of Home Lighting" (Miss D. Noakes), "Electrical Advertising" (H. Lingard), "Special Lighting Problems" (H. C. Wheat), "Colour Lighting" (R. O. Ackerley), "Floodlighting" (H. Lingard), and "Architectural Lighting" (Waldo Maitland).

A Group Photograph taken on the occasion of the Twenty-fifth E.L.M.A. Illumination Design Course.

The course terminated in a very pleasant dinner held at the adjacent Howard Hotel, Norfolk Street, on the evening of May 5th. There were numerous but brief addresses in connection with toasts by Mr. C. H. Cox (Vice-Chairman of the E.L.M.A. Council), Mr. L. E. Buckell, Mr. A. C. Cramb, Mr. W. J. Jones and others, representing various sections of electric lighting. An agreeable musical programme—supplemented by the wizardry of the gentleman who roamed about extracting unexpected articles from the pockets of highly respected pillars of the electrical industry—completed the evening's entertainment.



A Pleasing Indirect Unit.

"Self-lighting" Indirect Units

We are indebted to Messrs. Allom Bros. Ltd. for the accompanying view of an indirect lighting unit of a somewhat unusual character. This is described as "self-lighting," in the sense that provision is made to illuminate the exterior of the fitting, so that it does not appear "dead." The uncomfortable feeling associated with the apparent absence of any visible source of light is thus avoided. The rectangular shape of the fitting is also distinctive, and types we have seen are furnished with a semi-polished metallized exterior which gives a certain glistening effect and helps still further to remove any sensation of flatness.

Skirted Lamp-holders as a Safeguard against Shock

In our last issue we referred to the notice recently issued by the Factory Department of the Home Office drawing attention to the possible danger of shock from screw-cap electric lampholders, such as are now becoming usual owing to the prevalent use of lamps of high candle-power in factories. The danger may arise when fittings are being cleaned and lamps replaced, in view of the fact that the screw of the holder is a conductor forming part of the electric circuit. The use of double-pole switches is a considerable advantage, but there is always the possibility of the screw being inadvertently allowed to become "alive," and the additional safeguard of an insulating skirting completely screening the metal screw is highly desirable. How this safeguard works is evident from the accompanying illustration, for which we are indebted to the Credenda Conduits Co. Ltd. The picture is really self-explanatory. The protecting skirt, which screws into position completely covering the exposed screw of the lampholder, is unbreakable and can be readily fitted to any make of lampholder. We understand that this skirt will be fitted to all E.S. lampholders included in "Credalux" reflectors, and that in addition all industrial lighting fittings will be equipped with marked separate earthing terminals. These features are being added without extra charge or increase in price of the fitttings. The nature of the insulating skirt, as well as the earthing terminal, are illustrated in a leaflet recently issued by Credenda Conduits Ltd.

FIG. 1.—Showing exposed portion of the ordinary lampholder, with "Credalux" Protecting Skirt at the side.

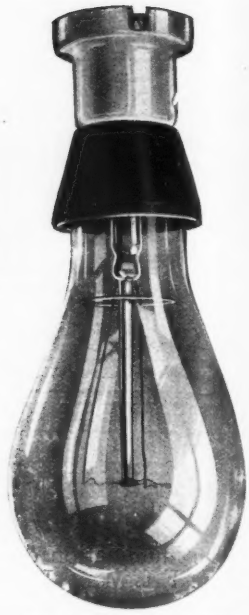


FIG. 2.—Showing the same lampholder with the Protecting Skirt in position.

A Well-lighted Show Window

The picture shown below of Messrs. Gooch's, Knightsbridge, typifies the somewhat difficult problem of a shop which makes use of an island showcase as well as the windows on either side. The difficulty in such cases consists in giving full illumination without the lamps becoming visible either from the pavement or the entrance way. In this case, apparently, the difficulty has been successfully overcome, and the photograph suggests that the windows have been more than ordinarily well lighted.

Showing Illuminated Showcase and Windows at Messrs. Gooch's, Knightsbridge.

Attention may also be drawn to the luminous canopy overhead—an increasingly popular device, especially in the case of stores with a central entrance-corridor—and the high ground illumination in the vicinity of the windows.

We understand that the familiar Holophane angled prismatic reflectors (No. 994 type), in conjunction with 150-watt lamps, approximately 14 ft. apart, were used for the main lighting, No. 983 reflectors and 100-watt lamps being installed further back to illuminate the deeper windows. This installation was carried out by Holophane Ltd., in conjunction with Mr. W. F. Piper, Messrs. Gooch's chief engineer.

The New Control Room of the West Ham Corporation Electricity Department's Generating Station, taken during the erection of the Control Panels.

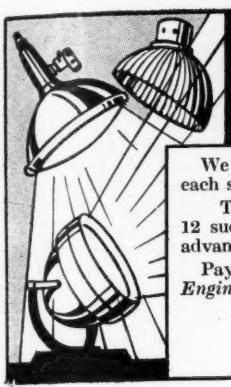
A Special Scheme of Lighting for the New Control Room at the West Ham Generating Station

A somewhat unusual and interesting scheme of lighting has recently been devised and installed in the new control room at the Canning Town Generating Station of the West Ham Corporation Electricity Department, under the direction of Mr. J. W. J. Townley, A.M.I.E.E., the Engineer and Manager.

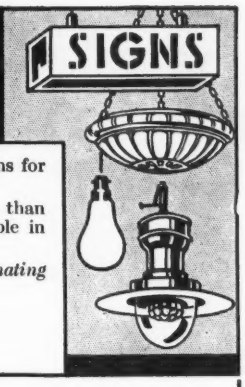
Essential requirements in the lighting of control rooms are the provision of adequate and well-diffused illumination and an entire absence of irritating reflections of the lighting system upon the faces of instruments and meters, apart from the actual panel surfaces. As it was intended to employ panels on both sides of the room, in addition to the ends, calculations were made on the basis of employing a continuous trough fitting, 65 ft. in length, suspended by steel channels attached to purlins fixed to the tie-rod structures. The framework of this fitting is of mild steel, aluminium sprayed, glazed with crevasse glass, behind which are arranged Holophane M.60 reflector units attached to special angled cleats alternated to the left and right.

The illumination intensity on the face of the control panels is in the order of 10 to 12 foot-candles. The lighting results are exceptionally effective and pleasing, and at all operating positions it is impossible to get any image of the actual source of light.

The two views of the control room, taken entirely by artificial light, which appear above give a good idea of the effect.



·WHERE TO BUY·
A DIRECTORY OF LIGHTING EQUIPMENT



We invite applications for spaces in this new section of the journal. Particulars of terms for each space (approx. 1 inch deep and 3½ inches wide) are given below.

These terms are equivalent to **half our ordinary advertising rates,** but not less than 12 successive monthly insertions can be accepted on this basis, and amounts are payable in advance.

Payment for an advertisement in this section entitles the advertiser to receive *The Illuminating Engineer* during the period of the contract.

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ACETYLENE LAMPS (150 models).

British-made Glassware

We have received from Messrs. Hailwood & Ackroyd Ltd. two recently issued leaflets illustrating their well-known British-made glassware. The first of these (G.W.151/5) depicts various forms of "Hailwood" bowls, chiefly three-ply and crystal satin-obscured, which are available in a great variety of shapes and sizes. The prices seem reasonable. A small specimen of one of these globes is seen on the left. We understand that a further range of glassware of this type, decorated in various designs and colours, will be introduced very shortly. The second list (H.W.30/3) features fittings suitable for public buildings, stores, hotels, churches, etc. These meet the demand for the substantial type of units often demanded in such cases, being of the enclosed dust-proof type and executed in three-ply opal glass, which gives ample diffusion of light with a minimum of absorption. The fittings have galleries of the cast hinged type with loose ventilated canopies, and the ceiling plates are also cast. A pleasing example of these globe unit fittings is seen in the accompanying right-hand illustration.

A typical Shade, available in crystal, satin-obscured and three-ply opal.

A New "Hailware" Globe Unit Fitting.

The Lighting of the Shakespeare Memorial Theatre

The lighting of the stage of the Shakespeare Memorial Theatre, Stratford-on-Avon, for which Messrs C. Harold Ridge and F. S. Aldred acted as supervising electrical engineers, presents many features of interest. We have received some details of the lighting equipment from the Strand Electric & Engineering Co. Ltd., who dealt with its manufacture and installation. The switchboard and dimmer, carrying 120 switches and all the protective fuses, is of special design. The footlights are portable, and may be placed in any position on the stage or forestage. The latter is, again, a novel device, enabling certain scenes to be played in front of the proscenium opening. It receives illumination from apparatus mounted in the auditorium. There is a special chamber over the proscenium arch with twelve apertures through which four-colour lighting can be projected. A distinctive feature of the lighting of the cyclorama is that apparatus is installed at the *top edges*, and so arranged that maximum intensity is obtained at the base, thus providing a "horizon effect." This apparatus includes a three-colour system, and the dimmers are specially wound to the formula of Messrs. Ridge & Aldred. Yet another device is the "constellation" of 30 stars obtained by means of 30 10-watt lamps fitted behind minute holes in the plaster fabric.

The whole of the decorative lighting in the auditorium (which, we understand, is also of a highly interesting nature) can be controlled from the stage switchboard.

"The Reflector"

The current issue of *The Reflector*, issued by Benjamin Electric Ltd., contains a description of the "Duoflux" floodlighting unit, which is deservedly regarded as a novelty. Readers of this journal are familiar with the ingenious combination of a large white vitreous-enamelled surface and an auxiliary chromium-plated reflector, which enables this unit to effect two objects—the floodlighting of a large vertical surface and the simultaneous illumination of an extensive ground area in front of it. Elsewhere in the journal is a description of the Ford Works at Dagenham, where the Benjamin system of lighting has been adopted.

At the Kandem Works

The *Kandem Quarterly Review* for April (published by Korting & Mathiesen Electrical Ltd.) contains some illustrations of the new Kandem Works at Parsons Green, where the Kandem lighting fittings and equipment are being produced. The sheet-metal section, spinning shop, fitting and tool room and spraying room are illustrated, the plant in the latter department being regarded as specially up-to-date. The journal also contains notes on various floodlighting installations, including the Incorporated Accountants' Hall and the familiar "Oxo" tower.

Contracts Closed

The following contracts are announced:—

THE BRITISH THOMSON-HOUSTON CO. LTD.:—

The War Office; for 12 months' supply of Mazda lamps.

The Great Western Railway; for 12 months' supply of Mazda vacuum and gas-filled lamps.

Substantial orders for Mazda lamps have also been placed by *The Admiralty, H.M. Office of Works, The General Post Office, Birmingham Corporation Tramways, and The Southern, London Midland & Scottish and Metropolitan Railways.*

THE GENERAL ELECTRIC CO. LTD.:—

London Midland & Scottish Railway Co. Ltd.; for 12 months' supply of Osram gas-filled and vacuum lamps, also Robertson carbon-filament.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD.:—

Salford Corporation Tramways; for 12 months' supply of Siemens traction lamps.